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Final Technical Report
October 1976

SPACE SURVEILLANCE SOFTWARE SUPPORT
Project Summary and Computer Program Documentation

PRC Information Sciences Company

ROME AIR DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
GRIFFISS AIR FORCE BASE, NEW YORK 13441

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APPROVED: John C. Cleary

JOHN C. CLEARY
Project Engineer

APPROVED: Rudolf C. Paltauf

RUDOLF C. PALTAUF, Lt Col, USAF
Chief, Surveillance Division

FOR THE COMMANDER: John P. Huss

JOHN P. HUSS
Acting Chief, Plans Office

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Volume 1, Part 1, Book 1.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The objective of this effort was to modify the RADC trajectory program orbit program and various radar cross section programs were modified to run on the RADC HIS 6180 computer under the GCOS system software. The RADC trajectory program was modified to include the capability of processing multiple (20) radar sites and multiple (20) targets in the program so that various radar parameters could be determined. This type of information is essential in performing radar coverage analyses for systems such as COBRA TALON, SEEK SAIL, COBRA DANE and COBRA JUDY. This portion of the effort is documented in Vol 1.

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Line 20 (continued) Vol VI documents a procedure for punching cards in ASCII format and reading the data onto a HP cassett for subsequent plotting with an HP9820 calculator system.

Vol VII documents some Radar Signature and Radar Scattering computer programs. A three dimensional plot program contained in this volume has been incorporated into the Interactive Radar Simulator for plotting three dimensional antenna patterns and cross section aspect angle histories.

ABSTRACT

The objective of the effort documented herein was to provide computer programming support for Space Surveillance system analysis. The two primary tasks of the effort were to complete the modification of the RADC Trajectory Program and to modify various radar cross-section and other computer programs so that they could be accessed from the interactive system for the RADC Radar Simulator. The documentation is organized as follows:

Volume I, Part 1, Book 1 - Project Summary and Computer Program Documentation (Chapters I-III of Volume I, Part 1)

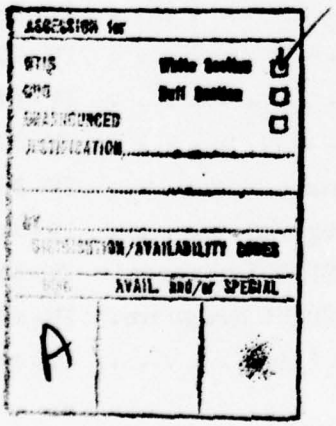
Volume I, Part 1, Book 2 - Computer Program Documentation (Chapter IV)

Volume I, Part 1, Book 3 - Computer Program Documentation (Chapters V-VI and Appendices A-E)

Volume I, Part 2 - RADC Trajectory Program - Numerical/ Analytical Data

Volume II - Generalized Data Entry and Plot Program

Volume III - Radar Signature and Radar Scattering Principles Investigation Software



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LIST OF TABLES

N.B. This LIST OF TABLES is for Books 1, 2, and 3 of Volume I, Part 1.

EVALUATION

The objective of this effort is to provide RADC systems engineers with the software commonly required for systems studies and the necessary software for plotting the data. The RADC trajectory program was modified to handle multiple targets and multiple radar sites. This program is required to perform coverage analyses for radar surveillance systems and has been used in support of SEEK SAIL, COBRA TALON and COBRA DANE. The cross section programs are used to determine the cross sections of targets that a radar system would be required to detect.

Since the RADC computer facility does not have a means of plotting data, most of the computer data generated was of limited value and extremely time consuming to use. Vol II documents a procedure for punching cards in ASCII format and reading data onto an HP cassette for subsequent plotting with an HP 9820 calculator system. This capability has proven extremely useful.

Vol III documents some Radar Signature and Radar Scattering computer programs. A three dimensional plot program contained in this volume has been incorporated into the Interactive Radar Simulator for plotting three dimensional antenna patterns and imaged wideband cross section data. These programs can serve as a starting point in the Tactical Target Identification Program.

John C. Cleary

JOHN C. CLEARY
Project Engineer

I. Introduction

A. Purpose and Scope

This document is Volume I, Part 1 of the technical report and computer program documentation for the Space Surveillance Software Support Contract, F-30602-75-C-0167, and is submitted in fulfillment of items A002 and A003 of the contract data requirements list. The work represented herein has been performed by Information Sciences Company (ISC) of Planning Research Corporation (PRC).

Contained herein are a summary of the work done on the project in the modification of the RADC Trajectory Program and others and the documentation for all computer programs modified.

B. Document Organization

Volume I, Part 1 is organized as follows:

Chapter II is, basically, the project summary. Appropriate exhibits are interleaved with the text material.

Chapters III and IV contain descriptions of the trajectory computer programs and radar cross-section computer programs, respectively. Included are source listings, sample test cases, and sample output from the test cases.

Chapter V contains descriptions of several auxiliary programs developed during the project, while chapter VI gives a list of references.

Appendices A through E contain analyses relating to the trajectory programs and descriptions of several small radar simulation-type programs.

Volume I, Part 1 is subdivided into 3 Books, Book 1 containing Chapters I-III, Book 2 containing Chapter IV, and Book 3 containing Chapters V-VI and Appendices A-E.

II. Space Surveillance Software Support Project Summary

A. Project Overview

The essential purpose of the Space Surveillance Software Support project was to provide computer programming support to aid Space Surveillance system analysis. This support took the form of modifying numerous, existing trajectory and radar-cross section programs and implementing them on the Honeywell 635 and 6180 computers at RADC. These programs were written in FORTRAN Y and placed in the appropriate time-sharing CARDIN format so that they could be accessible from the interactive system for the RADC Radar Simulator.

The work on the project was divided into two major task areas. One of these tasks was to bring the modification of the RADC Trajectory Program to a completion; the initial modification of the program was performed under Contract F30602-72-C-0136. This second modification included the capability of processing multiple radar sites and multiple targets in the program so that various radar parameters could be determined. The trajectory program can now accommodate up to 20 different radar sites and up to 20 targets.

The second task consisted of the modification and implementation of a number of trajectory, target model, and radar cross-section programs. There were 12 programs, altogether, involved in the task, and they were made executable via the remote batch system (CARDIN) of the RADC Honeywell computers. The 12 programs were the: Cobra Talon Trajectory Program, Nodal Crossing Prediction Program, Orbit Prediction Program, Cone Program, Cone-Cylinder Program, Frustum Program, Frustum-Cylinder Program, Hemisphere-Cylinder Program, Radar Scatter from Missile Program, Dihedral Corner Reflector Program, Cylinder Program, and Cylinder-Flare Program.

B. Program Development

The required modifications to the various computer programs and their

implementation on the Honeywell computing system were carried out in a certain manner. The procedure followed with respect to the two major tasks of the project will be described in the following paragraphs.

1. Modification of the RADC Trajectory Program

It was realized initially that the plotting capability had to be restored to the RADC Trajectory Program in order to make full use of it. The XYNECTICS plotter, by which plots of radar data were produced for the version of the program as modified under the original contract, was no longer available. However, the Hewlett-Packard 9820A calculator/plotter, with the capacity to read data cards was available. What was done was to write a short program to read the plot file created by the trajectory program and to punch out the file data onto cards for plotting on the HP9820A. This short program served as the basis of another plot program which could read the plot file created by the multiple site/multiple target version of the trajectory program and which was used quite often.

After checking that the first modified version of the trajectory program executed correctly, a detailed flow-chart of the major processing within the program was drawn up. This flow-chart was to serve as a basic reference for making further modifications to the program. It was thought that the modification involving multiple radar sites would be easier (less complicated) to include first in preference to that involving the multiple targets, and this is what was done. The multiple site addition was thoroughly tested using the results produced from prior, valid computer runs. The additional capability of printing out a message to the effect that an object was not detected by a radar site, when this was the case, was also incorporated. Next, the multiple target (or trajectory) capability was implemented. Basically, this involved putting an outer loop around the processing of the program; the multiple site modification had been made to process a single target only. Again, the multiple target addition to the program was carefully checked using previous, good computer runs.

After check-out of the multiple target/multiple site modification, other capabilities were added to the program. An atmospheric model for

simulating atmospheric effects on missiles was included and tested. This model was essentially the one that was in the original, unmodified version of the program. The generation of circular orbit trajectories with the program was tested, and the option to select either inertial velocity or burnout velocity was added. Finally, inclusion of radar parameter difference computations for multiple sites and trajectories was worked on.

2. Modification of Other Programs

The discussion here generally refers to all programs modified except the RADC Trajectory Program. These programs consisted of 3 trajectory-type programs and 9 target model or radar cross-section programs. The basic procedure which was followed in modifying these programs and implementing them on the Honeywell system is given below.

The existing source deck for a program was loaded on a disc file, compiled, and compilation errors were eliminated. Routines common to several programs were removed from the programs and processed separately. An attempt was then made to execute the error-free object form (also on a disc file) of the program using a given input test case. The results were compared against results obtained from previous, reliable runs of the program. If the results compared favorably, then the program inputs were converted to NAMELIST format, where it had not already been done so, in order to facilitate the use of the CARDIN system for program execution. When the results did not check out, a search was made for program and/or load errors, and after being found and corrected, then the input conversion to NAMELIST was made. The NAMELIST conversion was also tested through computer runs. The last thing that was done to a program was to produce plots of its computations as a final output and check-out. In most cases this meant adding a subroutine to the program to place the required data on a file so that it could be punched onto cards later. In addition, it should be mentioned that each program was executed in the CARDIN system by means of their respective job streams which had been placed on file.

C. Program Usage

This is a general discussion indicating how to use the programs which have been implemented under this contract. The reader should refer to other chapters of this volume for more detail.

1. RADC Trajectory Program

After the user selects the appropriate missile, radar, etc. input parameters, he must decide what input options to exercise. Basically, these options will be determined by what type of run he desires and what output he wants. Incidentally, in choosing values for the missile parameters (initial velocity, re-entry angle, etc.), the reader is referred to the appendices, Part 2 of this volume, section II. E, and other documents which may have been produced on the subject. By selecting appropriate values for the main processing switch, NSWTCH, and the plotting options, IPLOT1 or IPLOT2, the user can, for the most part, control the flow of a program execution and the output from it for immediate and/or later use. NSWTCH = 0 will cause the computation of trajectory parameters only, the printout of them, and the storage on a file of those needed for determining radar parameters. No radar computations will be made when NSWTCH = 0. By setting NSWTCH = 1, the program will produce trajectory data, storing appropriate parameters on a file as for NSWTCH = 0, and will calculate radar parameters (range, azimuth, etc.) for each of the input radar sites. NSWTCH = 2 will cause the generation of radar data, only, from trajectory data placed on file when NSWTCH = 0 or 1. By setting either plot option, IPLOT1 or IPLOT2, equal to .TRUE., the user can have radar data placed on a plot file for later access in producing plots. For this purpose, cards would be punched out from the file through the use of a short auxiliary program (1st program of Chapter V), and they would be plotted on the HP9820A by means of the Generalized Data Entry and Plot Program.

2. Other Trajectory Programs and Target Model Programs

Most of these programs do not have any input options so that their use is relatively straight-forward. The possible exceptions are the Cobra Talon Trajectory Program which requires the setting of such switches

as those for selecting the nominal trajectory and inertial velocity and the Orbit Prediction Program which has a switch for putting data on a plot file. The basic procedure in running any one of the programs would be to choose desired values for the input parameters, enter them in the appropriate job stream file, and execute the job stream via CARDIN and the Honeywell 6180 computer. A plot file is created automatically when a target model (cross-section) program is executed. If one desires the file to be punched onto cards, the BPUNCH subsystem of CARDIN can be utilized as each file is written in BCD format. For the Cobra Talon and Orbit Prediction Programs, if it is desired to punch out their plot files, the appropriate auxiliary punch programs would be employed.

D. Conclusions

There are several accomplishments of this project which have resulted from the work performed:

The RADC Trajectory Program has been made into a more efficient tool for the performance of radar system analysis. It can now process up to 20 different radar sites and up to 20 targets (or trajectories) and determine radar coverage parameters. Data from multiple trajectories can be permanently stored on a file and used many times over for computing radar parameters. This would result in considerable saving of computer time as the trajectory generation is by far the most time-consuming process in the program. Plots of radar data can now be made on the HP 9820A calculator/plotter. Refer to Figure II-1 for an example of such a plot. Also, the RADC Trajectory Program has been implemented on the Honeywell 6180 CARDIN subsystem, so that it is executable by means of the interactive system for the RADC Radar Simulator.

The target model programs have been checked out on the Honeywell 635 and 6180 computers and made accessible through the remote batch CARDIN subsystem. The capability of storing data for plotting was also added to these programs. The Cobra Talon Trajectory Program had several corrections made to it while it was being implemented on the CARDIN system. It also was given the added capability to generate circular orbits. In addition, the Orbit Prediction Program (as well as the Cobra Talon Program) was

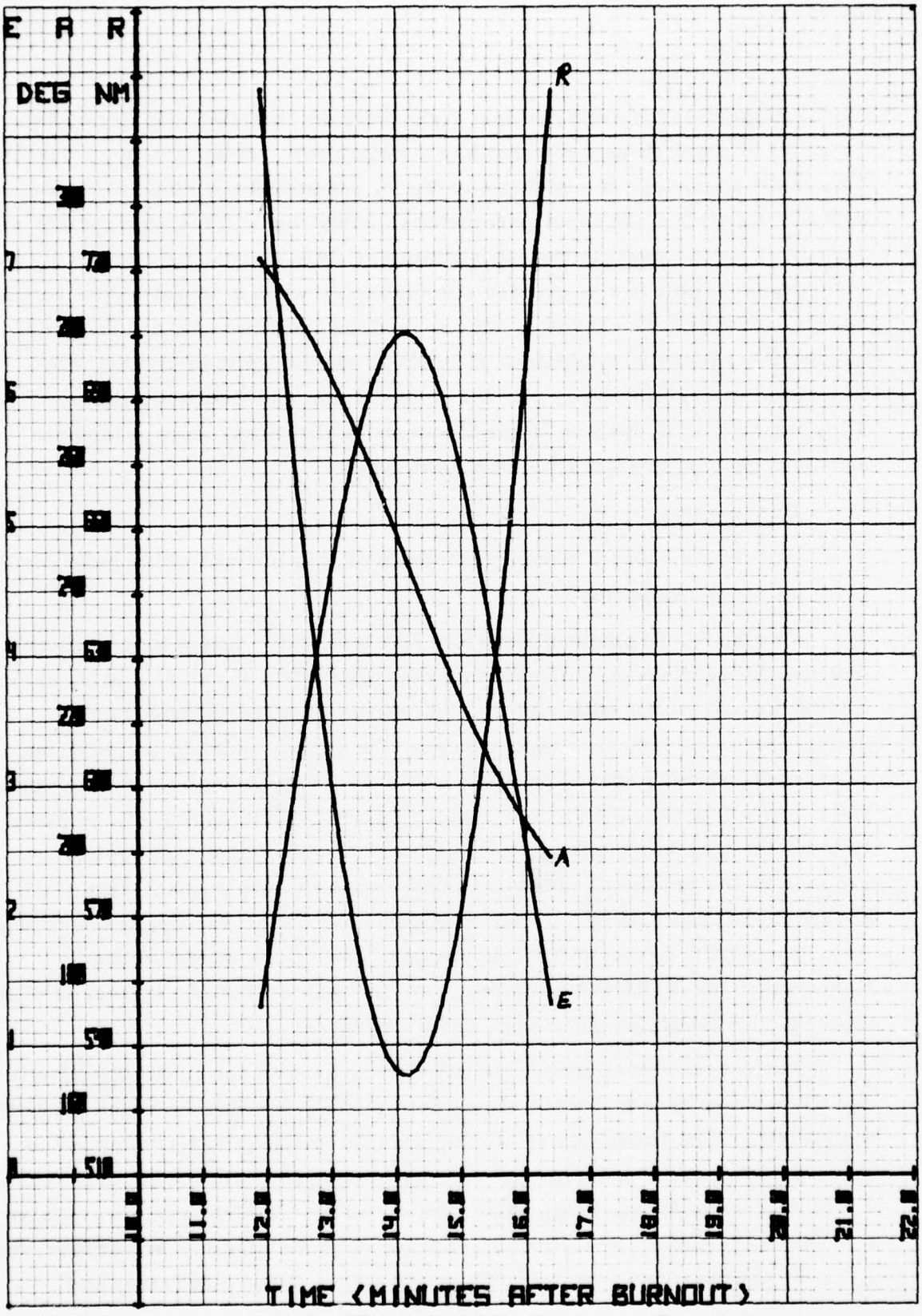

Figure II-1. Plot from RADC Trajectory Program

provided the capacity for obtaining plots of its results, and both it and the Nodal Crossing Prediction Program were made executable via CARDIN.

In the course of modifying and implementing the many programs involved in this project, several computer runs were attempted in which a spaceborne radar system was simulated. A plot from one of the runs, showing the decrease in range of a missile as it approaches impact at the radar, is illustrated in Figure II-2.

Several observations concerning the RADC Trajectory Program can be made; some of them may also apply to the Cobra Talon Trajectory Program. Most of the major trajectory and radar computations in the program are currently performed in double precision floating point. It might be worthwhile to perform an experiment on the program with the computations changed to single precision. If the experiment is successful, the benefit would be a significant reduction in both computer processing time and required memory. In the modified program, the trajectory data stored on file was in single precision; radar computations made with this data showed no noticeable difference from those made with double precision data. The basic integration time for trajectory interations was set at 0.01 min. In the original program this time changed according to certain conditions, e.g., altitude of missile below a certain level. Results from the modified program were compared, in several instances, against corresponding results from the original program for which the integration time varied and no significant difference was discovered.

E. Trajectory Computer Programs

The trajectory computer programs deserve special attention here because they are the most important and widely used of the programs worked on for this project. This section could be considered as an introduction to their detailed description in chapter III and the analyses of Appendices A through E and Volume I, Part 2. Most of the following paragraphs have been excerpted from the "Cobra Talon Study Computer Programs" document (see References). Updates have been inserted in the text where appropriate.

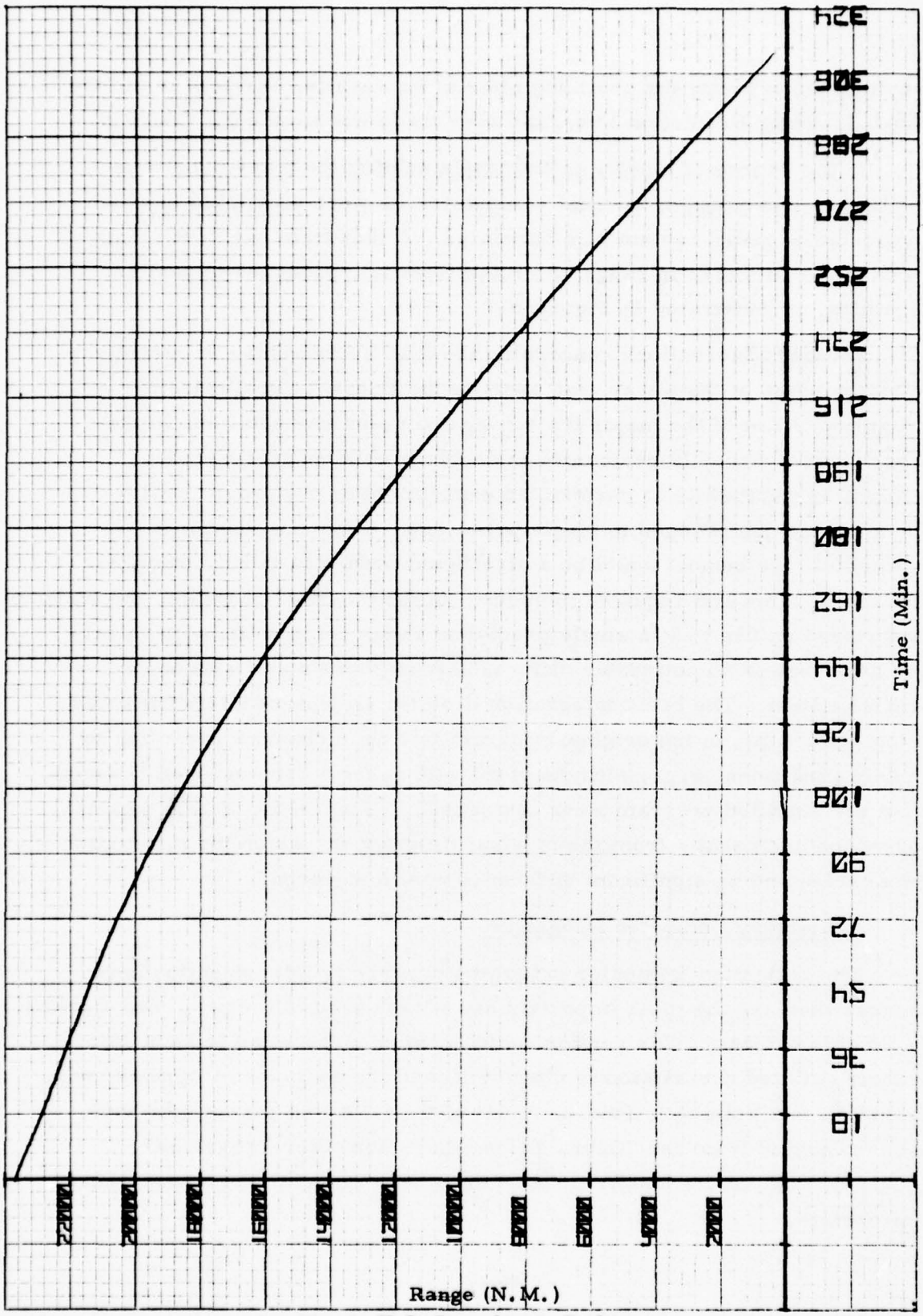

Figure II-2. Spaceborne Radar

A missile trajectory computer program developed at RADC* had been modified to zero-in on a specific impact point. This is accomplished by utilizing the position and velocity vectors at the actual impact point as new initial conditions. Then the actual impact point is moved to the desired impact point and run backwards to burnout, which is time zero. Thus, a new set of initial burnout conditions is obtained for the third trajectory which zeros in on the desired impact point. This is of particular interest for reentry radars. Additional trajectories can be run which are perturbed from the nominal trajectory (i.e., the third trajectory); the radar differences from the nominal trajectory (3rd) are then printed out. This option is obtained by setting the FORTRAN variable KZ=0 in the Cobra Talon Program and = F in the RADC Trajectory Program.

In a study which OCSA was required to perform, the launch point and missile capability were known. Therefore, the above computer program was modified** so that the launch point was not changed. The impact point was allowed to stay where the missile capability put it. This means that the first trajectory was made the nominal trajectory. The second and third trajectories were skipped and additional trajectories were perturbed from the first trajectory. This option is obtained by setting KZ=1 in the Cobra Talon Program and = T in the RADC version.

The original program*** was such that every time initial burnout conditions were changed, the computer program was changed. This computer program was changed to accept input data without changing the computer

* See Reference 4, Page VI-2
** See Reference 3, Page VI-2
*** See Reference 4, Page VI-2

program every time. This allows the time-sharing system to be used for production runs. The computer program was also modified to print-out all the input conditions for future reference.

To determine the radar coverage parameters a separate version of the trajectory computer program was utilized which prints the missile trajectory and radar coverage data every tenth of a trajectory minute. In addition, the radar slant range is printed out in nautical miles. For the case where differences are calculated, a second version of the computer programs prints out data for every trajectory minute. Also, the differences in radar slant range from the nominal trajectory are printed in feet. The original computer program was modified to calculate the total angular separation in the radar beam from the nominal trajectory.

The outputs of the computer program can be used to determine the radar systems information needed to fill in Table II-1 .

To simulate missile trajectories, burnout velocities referenced to the earth's surface are required; therefore, set the FORTRAN variable INERTL = 0. If satellite orbits are to be simulated, inertial velocities must be used; therefore, set INERTL = 1. This causes the earth's rotation (W) to be subtracted from $\dot{\lambda}$, the total longitude angle velocity component of the vehicle which is in subroutine ICERBM(P) as the FORTRAN variable XD(3). When a simulated trajectory is required for a specified inclination (INC) angle, the missile heading angle BETA measured clockwise from north has to be calculated. Figure II-3

LAUNCH AZ ° FR TRUE NO.	INIT DET RANGE NM	MIN. DET RANGE NM	MAX DET RANGE NM	FINAL DET RANGE NM	MAX EL ANGLE DEG	TOT AZ ANGLE DEG	MAX RANGE RATE NM/ SEC	MAX EL RATE DEG/ SEC	MAX AZ RATE DEG/ SEC	TOT OBS. TIME MIN
100										
120										
170										
190										
200										
230										

EXPLANATORY NOTES:

1. Unless otherwise specified, the numbers in parenthesis list time (min. after burnout) at which value would be observed.
2. The total Az Angle is the az angle required by radar to observe missile from horizon to horizon (0.5° el. angle). The numbers in parenthesis indicate initial and final detection azimuths (true North) from radar site.
3. The Total Observation Time is the time target would be within radar field-of-view. In parenthesis are cited initial and final observation times.

TABLE - II-1. Radar Systems Information Chart

Section III. B. documents the PRC version of the RADC Trajectory Program. PRC's effort was directed towards making the program run more efficiently on HIS 6180 and making the program relatively easy to use for the user. This version of the program can handle multiple trajctories for multiple radar sites. To save computer run time the trajectories of interest can be stored on disc and/or magnetic tape. Then coverage parameters for the radar sites of interest can be handled. Since the trajectory simulation requires the greatest amount of computer time this is more efficient and allows other radar sites which may come into consideration at a later date to be easily included.

Appendix A discusses the ejection velocity geometry used for multiple trajectories. Other appendices discuss procedures for determining burn-out velocity input parameters for the missile case. The inertial velocity for orbital cases is determined from*

$$VI = \sqrt{\frac{\mu}{a}} \qquad \text{(circular orbit)}$$

$$VI = \sqrt{\mu\left(\frac{2}{r} - \frac{1}{a}\right)} \qquad \text{(elliptical orbit)}$$

where $r = \dfrac{a(1-e)^2}{1 + e\cos\theta}$

θ = true anomaly = angular position along orbit referenced to perigee

$\mu = 5.0675004 \times 10^{19}\ ft^3/min^2$

* See "Radar Handbook" by Skolnik

μ = 1.407639 x 10^{16} ft^3/sec^2

RE = 2.0925640 x 10^7 ft (earth's equatorial radius)

e = orbit eccentricity (e = 0 for circular orbit)

a = semi-major axis

r = distance from earth's center to satellite/missile position

Section III. C. documents the Cobra Talon version of the RADC Trajectory Program. This version has the capability of handling multiple targets ejected from the nominal trajectory for a single radar site.

III. Description of Trajectory Computer Programs

A. Introduction

This section provides a description for four (4) simulation-type computer programs which have been written in FORTRAN Y to execute under the Honeywell 6180 GCOS operating system. These programs, basically, generate trajectories for missiles and satellites and determine radar coverage parameters and are the following:

1. RADC Trajectory Program
2. Cobra Talon Trajectory Program
3. Nodal Crossing Prediction Program
4. Orbit Prediction Program

Program 1 is a second modification of the general perturbation program of George A. Ellis, the initial modification of which was done under Contract F30602-72-C-0136. Program 2 is essentially the version of Mr. Ellis' program which was used in conjunction with the Cobra Talon radar study by John C. Cleary and Leonard C. Gratch. Refer to sections III. B and III. C for documentation and further references on these programs. Programs 3 and 4 were developed under the direction of Mr. Cleary for predicting the path of an earth-orbiting satellite and determining radar look-angles for it. Sections III. D and III. E document these programs and mention a reference for them. All the programs have been put in the appropriate time-sharing CARDIN format by PRC/ISC so that they are executable by means of the RADC Interactive Radar Simulator.

B. RADC Trajectory Program

1. Introduction

This computer program is a second modification of the general perturbation program (PROGRAM TRAJ) of George A. Ellis, previously modified under Contract F30602-72-C-0136. The previous modification retained much of the mathematics and basic processing methodology of the Ellis program but differed primarily in its input/output capabilities and increased modularity. More input flexibility and capacity for generating trajectory data (relative to a radar site) for use with an off-line plotter were major characteristics of the first modified version. This second refinement of the program brought the modification of the RADC Trajectory Program to completion. The capacity for accommodating multiple DSSR sites and multiple targets has been added to the program, while still maintaining the capabilities of the first modification.

The basic function of the program is to generate the trajectory of a ballistic missile or an earth-orbiting satellite. It predicts the position, velocity, and acceleration of the vehicle and can compute radar parameters (range, azimuth, elevation, etc.) relative to a number of radar sites. The user has the option of producing just trajectory data and no radar data, or both trajectory and radar data, or just radar data from trajectory data stored during a previous run. The reader is referred to a number of documents describing prior versions of the program. Several of these are: "Missile/ Satellite Trajectory Program" April 1974, a user's guide by R. Conti, PRC; "Simulation Program for Three Degrees of Freedom Trajectories", Technical Memorandum No. EMA-TM-66-5, Sept. 1966, by George A. Ellis, et al; "Cobra Talon Study Computer Programs", Technical Memorandum RADC/OC-TM-71-4, May 1971, by John C. Cleary and Leonard C. Gratch. Also, refer to the analytical description in Volume I, Part 2 of this report.

2. Computer Program Operating Environment

a. Computer

Honeywell 6180.

b. Source Language

FORTRAN Y under GCOS.

c. Memory Requirement

40K words.

d. Typical Processing Time Required

0.12 hours (432 seconds)

e. Peripheral Equipment Requirement

One disc file (file code: 08)

Three disc or tape files (file codes: 09, 10, 11)

f. Non-system Subroutines Required

ATMOSP	Atmospheric model.
BALCOF	Ballistic coefficient subroutine.
CONVER	Conversion to radar coordinates.
EQTNX	Computation of acceleration components.
ICERBM	Computation of geocentric spherical components.
INITAL	Initialization subroutine.
INTRAJ	Input trajectory and radar data stored on files for computations.
INPUT	Input subroutine.
OUTPUT	Output subroutine.
RKG	4th Order Runge-Kutta-Gill.

g. Program Limitations

The program can accommodate no more than 20 perturbed trajectories.

The maximum number of trajectories which can be generated will vary with the selection of the nominal trajectory. When the nominal trajectory for the trajectory perturbations is the first trajectory,

the first trajectory and up to 20 perturbed trajectories can be generated, for a total of 21. When the nominal trajectory is the third trajectory, there will be generated the first, backward, and third trajectories, and up to 20 perturbed trajectories, for a total of 23.

The program can accommodate no more than 20 different radar sites.

For the radar parameter difference calculations, no more than 10 different trajectories, 10 different radar sites, and 5 different sightings of a trajectory by a site are allowed.

3. Inputs

The following two sets of inputs (INPUT1 and INPUT2) are for the program controls.

NAMELIST INPUT 1

Symbol Name	Units	Description
NTRAJ	None	Total number of trajectories simulated. If KZ = T, the actual number of trajectories simulated will be NTRAJ-2. NTRAJ cannot exceed 23.
TM	Min.	Maximum time allowed for any trajectory from start to finish.
NSWTCH		Main processing switch for the program.
	0	Produce trajectory data only. The data for each trajectory generated will be placed on a file for later access.
	1	Produce both trajectory and radar data. The trajectory data will be placed on a file.
	2	Produce radar data only.

NAMELIST INPUT 2

Symbol Name	Units	Description
IOUT1		Printout option No. 1.
	T	Print out the 13 trajectory parameters from the radius of the missile (or satellite) trajectory to the acceleration in longitude for each time point of each trajectory. The time points are spaced by OUTINC, and each trajectory is considered relative to a geocentric coordinate system.

Symbol Name	Units	Description
	F	Print out the 7 trajectory parameters from the radius to atmospheric density for each time point of each trajectory generated.
IPLOT1		Plotting option 1.
	T	Produce a plot file of the 8 radar parameters from slant range to inertial phi for each time point each detected trajectory. This plot file consists of data produced from all input radar sites.
	F	Do not produce this plot file.
IPLOT2		Plotting option 2.
	T	Produce a plot file of the 13 radar, parameters (calculated for each site) from slant range to heading angle for each time point of each detected trajectory.
	F	Do not produce this plot file.
IOUT2		Printout option 2.
	T	Print out the 13 radar parameters from slant range to heading angle for each time point of each detected trajectory. The radar parameters of each trajectory are computed relative to the input radar site coordinates.
	F	Print out the 8 radar parameters from slant range to the inertial phi angle for each time point of each detected trajectory.
KAT		Atmospheric model option.
	T	Use the atmospheric model. Atmospheric effects will be considered in the generation of the trajectories.

Symbol Name	Units	Description
	F	Do not use the atmospheric model.
KZ		Nominal trajectory selection switch.
	T	Select the 1st trajectory as the nominal trajectory for the trajectory perturbations.
	F	Select the 3rd trajectory as the nominal trajectory.
SPHERE		Spherical earth model option.
	T	Use the spherical model of the earth.
	F	Do not use the spherical model.
IOUT3		Printout option for radar parameter differences.
	T	Print out the radar parameter differences.
	F	Do not print out the differences.
OUTINC	Min.	Increment between time points for printout.
INERTL		Inertial velocity option.
	T	The initial missile velocity input is the inertial velocity.
	F	The initial velocity is the burnout velocity.

Note: The spherical model of the earth is the only one currently present in the program, so that the value of SPHERE has no effect on a program run. Also, IPLOT1 and IPLOT2 cannot be simultaneously true. Only one can be true and the other false, or both can be false.

The following set of inputs are for the initial state vector of the interceptor and the subsatellite parameters.

NAMELIST INPUT3

Symbol Name	Unit	Description
GAM	Deg.	Re-entry angle of the missile with respect to the vertical.
BETA	Deg.	Heading angle of missile w.r.t. relative north.
VO	Ft./Sec.	Velocity of the missile relative to burnout at epoch or inertial velocity of the missile.
HX	Ft.	Height of missile at burnout or initialization of trajectory.
THE	Deg.	Geocentric latitude at burnout, + north and - south of equator.
GLAM	Deg.	Geocentric longitude at burnout, east of Greenwich.
THES	Deg.	Geocentric latitude of the target (subsatellite), + north and - south of equator.
GLAMS	Deg.	Geocentric longitude, east of Greenwich, of the target.

Note: The inputs GAM through GLAM above could also be interpreted as parameters for an orbiting satellite, rather than a missile.

The following set of inputs describes the radar sites for which computations are to be made. INPUT4 is not read if NSWTCH = 0.

NAMELIST INPUT4

Symbol Name	Unit	Description
NSITE	None	The number of radar sites to be simulated. NSITE cannot exceed 20.

Symbol Name	Unit	Description
SLAT	Deg.	Geocentric latitudes of the radar sites, + north and - south of equator. SLAT is an array.
SLONG	Deg.	Geocentric longitudes of the radar sites, west of Greenwich. SLONG is an array.
SALT	Ft.	Altitudes of the radar sites above sea level. SALT is an array.
ELIM	Deg.	Maximum co-latitude of the elevation angle for which objects are detected by all the radar sites.

If NTRAJ > 3, the velocity perturbations are input:

NAMELIST INPUT5

Symbol Name	Unit	Description
A	Ft./Sec.	Out of trajectory plane perturbation, + ejected to the left of the nominal trajectory. A is an array.
B	Ft./Sec.	In plane perturbation, + ejected backwards from nominal trajectory. B is an array.
C	Ft./Sec.	In plane perturbation, + ejected backwards from nominal trajectory. C is an array.

4. Output

The output from the RADC Trajectory Program is a variable depending upon the selection of the program options. First, a printout of the input parameters for the program run is produced, this printout and the input parameters, themselves, varying according to the values of the options. Then follows the printout of the results of the program execution. The main processing switch for the program (NSWTCH) has a great deal of control over the type of output coming from the program. If NSWTCH=0, only trajectory data will be printed out. If NSWTCH=1, both trajectory and radar data will be produced. And if NSWTCH=2, only radar data will be outputted. The following lists indicate what printout is produced with what option values.

When NSWTCH=0 or 1 and IOUT1=.FALSE., the following printout of trajectory parameters for every trajectory generated is produced:

Symbol Name	Units	Description
NTRJ	None	Number of trajectory. When KZ=T, the second trajectory will be numbered 4.
TIME1+(I/IO) *OUTINC	Min.	Formula for the calculation of a trajectory time point for printout. The value calculated (and printed out) represents the time from burn-out of the missile along its trajectory or time from the initiation of the satellite orbit or missile path, if that is appropriate.
OUTTRJ(1)	Ft.	Earth-centered radius of the trajectory or the distance of the missile or satellite from the earth center at the time point above.

Symbol Name	Units	Description
OUTTRJ(2)	Deg.	Position in latitude of the missile/satellite in its trajectory at the above time point.
OUTTRJ(3)	Deg.	Position in longitude of the missile/satellite, east of Greenwich.
OUTTRJ(4)	Ft.	Altitude above sea level of the missile.
OUTTRJ(5)	Ft./Sec.	Inertial velocity of the missile/satellite along its trajectory.
OUTTRJ(6)	$Ft.^2/Slug$	Ballistic coefficient at the time point.
OUTTRJ(7)	$Slug/Ft.^3$	Atmospheric density at the trajectory time point for the missile/satellite altitude.

The trajectory parameters corresponding to the next time point to be printed out are stored in OUTTRJ(8) - OUTTRJ(14), and so on for each time point to be printed. NTRJ is printed at the top of a page of printout. The time point - OUTTRJ(7) are printed out on one line of a page, next time point - OUTTRJ(14) on the next line, etc., up to 52 lines per page. NTRJ will start the next page. Each successive time point printed out will differ by OUTINC from the previous one. This may not hold true for the very last time point as it may differ from the previous one by 0.01 min. or more.

If IOUT1 = .TRUE. and NSWTCH=0 or 1, the following trajectory parameters are printed out:

Symbol Name	Units	Description
NTRJ		
TIME1+(I/IO) *OUTINC		
OUTTRJ(1)		Described for IOUT1= .FALSE.

Symbol Name	Units	Description
OUTTRJ(2)		
OUTTRJ(3)		
OUTTRJ(4)		
OUTTRJ(5)		
OUTTRJ(6)		
OUTTRJ(7)		
OUTTRJ(8)	Ft./Sec.	Geocentric radial velocity component of the missile/satellite at the time point.
OUTTRJ(9)	Deg./Sec.	Geocentric latitude velocity component of the missile/satellite.
OUTTRJ(10)	Deg./Sec.	Geocentric longitude component of velocity of the missile/satellite.
OUTTRJ(11)	Ft./Sec.^{2}	Geocentric radial acceleration component of the missile/satellite.
OUTTRJ(12)	Deg./Sec.^{2}	Geocentric latitude component of acceleration of the missile.
OUTTRJ(13)	Deg./Sec.^{2}	Geocentric longitude component of acceleration of the missile.

What was said above for the printout when IOUT1 = .FALSE. essentially holds for IOUT1 = .TRUE. The difference is that storage of the trajectory parameters is not the same. The trajectory parameters corresponding to the next time point to be printed out are stored in OUTTRJ(14)-OUTTRJ(26), and so on for each time point to be printed out.

The number and types of trajectories generated are basically controlled by the input variables NTRAJ and KZ. If only one trajectory is desired, NTRAJ would be set equal to one. If perturbed trajectories are desired with the nominal trajectory as the first trajectory, NTRAJ would be set ≥ 4 and KZ = .TRUE. The trajectories on the printout would be

numbered in the order 1, 4, 5, _ _ _ _ , number 4 representing the first perturbed trajectory. If perturbed trajectories are desired with the nominal trajectory as the third trajectory, NTRAJ would be set $\geq$ 4 and KZ = .FALSE. In this case the trajectories would be numbered 1, 2, 3, 4, _ _ _. Trajectory 2 is the so called "backwards" trajectory, with time going in descending order.

Now if NSWTCH =1 or 2, the following set of radar parameters will be printed out for each radar site and each trajectory detected by the sites. For NSWTCH=1, the radar data will follow the appropriate trajectory data printout. For NSWTCH=2, there will be no trajectory data printout, only radar data. There will be no radar data printout for the second trajectory and if a trajectory is not visible to a radar site, a message to that effect will be produced. For IOUT2 = .FALSE., the radar parameters printed out are:

Symbol Name	Units	Description
NTRJ	None	Trajectory number.
ISITE	None	Radar site number.
SC1	Deg.	Position in latitude of the radar site.
SC2	Deg.	Position in longitude of the radar site.
TIME2+(I/IO1) *OUTINC	Min.	Trajectory time point. See description for IOUT1 = .FALSE. under trajectory data output.
OUTRAD(1)	N.M.	Radar slant range to the missile/satellite for the time point.
OUTRAD(2)	Ft./Sec.	Slant range rate for the time point.
OUTRAD(3)	Deg.	Radar elevation angle for the missile/satellite at the time point.
OUTRAD(4)	Deg./Sec.	Elevation angle rate.

Symbol Name	Units	Description
OUTRAD(5)	Deg.	Radar azimuth angle, measured clockwise from north.
OUTRAD(6)	Deg./Sec.	Azimuth angle rate.
OUTRAD(7)	e.r.u.	Trajectory radius in earth radii units.
OUTRAD(8)	Deg.	Inertial phi angle.

The radar parameters corresponding to the next time point to be printed out are stored in OUTRAD(9)-OUTRAD(16), and so on for each time point to be printed. NTRJ, ISITE, SC1, SC2 are printed at the top of a page of printout. The time - OUTRAD(8) are printed out on one line of a page, next time point - OUTRAD(16) on the next line, etc., up to 52 lines per page. NTRJ, ISITE, SC1, SC2 will start the next page. Each successive time point printed out will differ by OUTINC from the previous one, except that the difference between the first and second time points and the next-to-last and last could be less than OUTINC.

What was said in the previous paragraph applies to one sighting of the missile/satellite by a radar site. Each sighting of the missile/satellite by a site will have a group of printouts similar to what is described above. The first time printed out for a group represents the initial time of sighting by the radar for the current sighting (or current period in which the missile/satellite is in the radar coverage). The last time represents the time at which the missile was last visible to the radar for the current sighting. The printout of radar parameters, in this way, can reflect when a missile moves in and out of the radar coverage.

When IOUT2 = .TRUE. and NSWTCH=1 or 2, the following radar parameters are printed out:

Symbol Name	Units	Description
NTRJ		
ISITE		
SC1		
SC2		

Symbol Name	Units	Description
TIME2+(I/IO1) *OUTINC		Described under IOUT2 = .FALSE.
OUTRAD(1)		
OUTRAD(2)		
OUTRAD(3)		
OUTRAD(4)		
OUTRAD(5)		
OUTRAD(6)		
OUTRAD(7)		
OUTRAD(8)		
OUTRAD(9)	Ft./Sec.^{2}	Radar slant range acceleration of the missile/satellite.
OUTRAD(10)	Deg./Sec.^{2}	Radar elevation angle acceleration.
OUTRAD(11)	Deg./Sec.^{2}	Radar azimuth angle acceleration.
OUTRAD(12)	Deg.	Missile re-entry angle.
OUTRAD(13)	Deg.	Missile heading angle.

Essentially what was said for the printout for IOUT2 = .FALSE. holds true for IOUT2 = .TRUE., except that the storage of data is different. For example, time point - OUTRAD(13) is printed on one line, next time point - OUTRAD(26) printed on the next line, etc.

Radar Parameter Differences

The radar parameter difference calculations, as of this writing, have not been fully implemented. The following discussion will describe the output as it will be produced from the calculations.

If IOUT3 = .TRUE., the program will compute radar parameter differences and print them out, after the last set of trajectory and/or radar data printed out. The differences will be out-putted for each radar site and for each perturbed trajectory when NTRAJ $\geq$ 4 in a manner basically

similar to the printout of the radar parameters discussed previously. The differences represent the values obtained by subtracting the radar parameters for the perturbed trajectories from the corresponding parameters for the nominal trajectory (trajectory #1 or #3).

Radar data required for the computations must be stored on the plot file and is identical to the data that is placed on the file for producing plots. Normally, this data would be stored on the file as the result of the execution of the parts of the program preceeding the parameter difference portion. This data could also be stored from a prior execution of the program and used in the difference computations. However, this latter procedure is not recommended since all program inputs required by the computations should be identical to the corresponding ones that were used when the plot file was created. When IOUT3 = true, therefore, IPLOT1 or IPLOT2 should be set = true and NSWTCH = 1 or 2. It should be pointed out that the input variable KZ will determine which trajectory will be the nominal trajectory for the computations. With KZ = true, the nominal trajectory would be the first trajectory; with KZ = false, it will be the third trajectory. The following list defines the output parameters when IOUT2 = false.

Output Parameter	Units	Description
NTRJ	None	Trajectory number.
ISITE	None	Radar site number.
SC1	Deg.	Position in latitude of the radar site.
SC2	Deg.	Position in longitude of the radar site.
Time	Min.	Time from burnout or from initiation of the trajectory of the target (or missile/ satellite). Each time printed out will be a time at which both the nominal trajectory and the current perturbed trajectory were detected by the current site.
Slant Range	N.M.	Difference in radar slant (nominal trajectory slant range - perturbed trajectory slant range) for time.

Output Parameter	Units	Description
Sl Range Rate	Ft. /Sec.	Difference in radar slant range rate.
Elevation	Deg.	Difference in the radar elevation look-angles to the trajectories (nominal-perturbed) or targets.
Elevation Rate	Deg. /Sec.	Difference in radar elevation angle rate.
Azimuth	Deg.	Difference in radar azimuth angle, measured clockwise from north.
Azimuth Rate	Deg. /Sec.	Difference in radar azimuth angle rate.

If IOUT2 = true, the following list of output parameters is produced.

Output Parameter	Units	Description
NTRJ		Described in the previous list.
ISITE		
SC1		
SC2		
Time		
Slant Range		
Sl Range Rate		
Elevation		
Elevation Rate		
Azimuth		
Azimuth Rate		
Sl Range Rate Dot	Ft. /Sec.^{2}	Difference in radar slant range acceleration.
Elevation Rate Dot	Deg. /Sec.^{2}	Difference in radar elevation angle acceleration.
Azimuth Rate Dot	Deg. /Sec.^{2}	Difference in radar azimuth angle acceleration.
Angular Separation in Radar Beam	Deg.	Total angular separation in the radar beam.

Plot File

The previous paragraphs under Output have dealt with the printout on listing paper from a program execution. The following paragraphs will describe the plot file which can be created on disc or tape if the user exercises the appropriate input options. By setting either IPLOT1 or IPLOT2 = .TRUE. (when NSWTCH = 1, 2) data will be placed on the file so that off-line plots of radar parameters (range, azimuth, elevation, etc.) can be produced. The plots can be drawn, from data cards punched out from the file, on the Hewlett-Packard 9820A calculator/plotter through the use of the Generalized Data Entry and Plot Program. See Volume II for a detailed description of this program. The Plot Program XYNETICS Plotter, developed for the first modified version of the trajectory program, can handle the case of one trajectory and one radar site, only. The format of the file for each generated trajectory which is subject to a radar search and detected by the radar is given below. Logical records nos. 1 through 7, ..., n contain the data for one sighting of the trajectory (or target) by a radar site. They will be repeated for each additional sighting by the site; they will also be repeated for each sighting of the trajectory by each additional radar site, if multiple sites are to be processed. Refer to Figure III-1 which illustrates the layout of the file.

Logical Record No. 1

Symbol Name	Units	Description
TIME3	Min.	Initial time of sighting missile trajectory at the radar site.
IPLOT2		Plotting option 2.
	T	Plots for 13 different radar trajectory parameters can be produced. A total of 12 plots can be drawn.
	F	Plots for 8 radar trajectory parameters can be produced. A total of 7 plots can be drawn.
IO2	None	Number of radar parameters which can be plotted. IO2=8 if IPLOT2 if false, 13 for IPLOT2 true.

Radar Site 1, 1st Sighting:

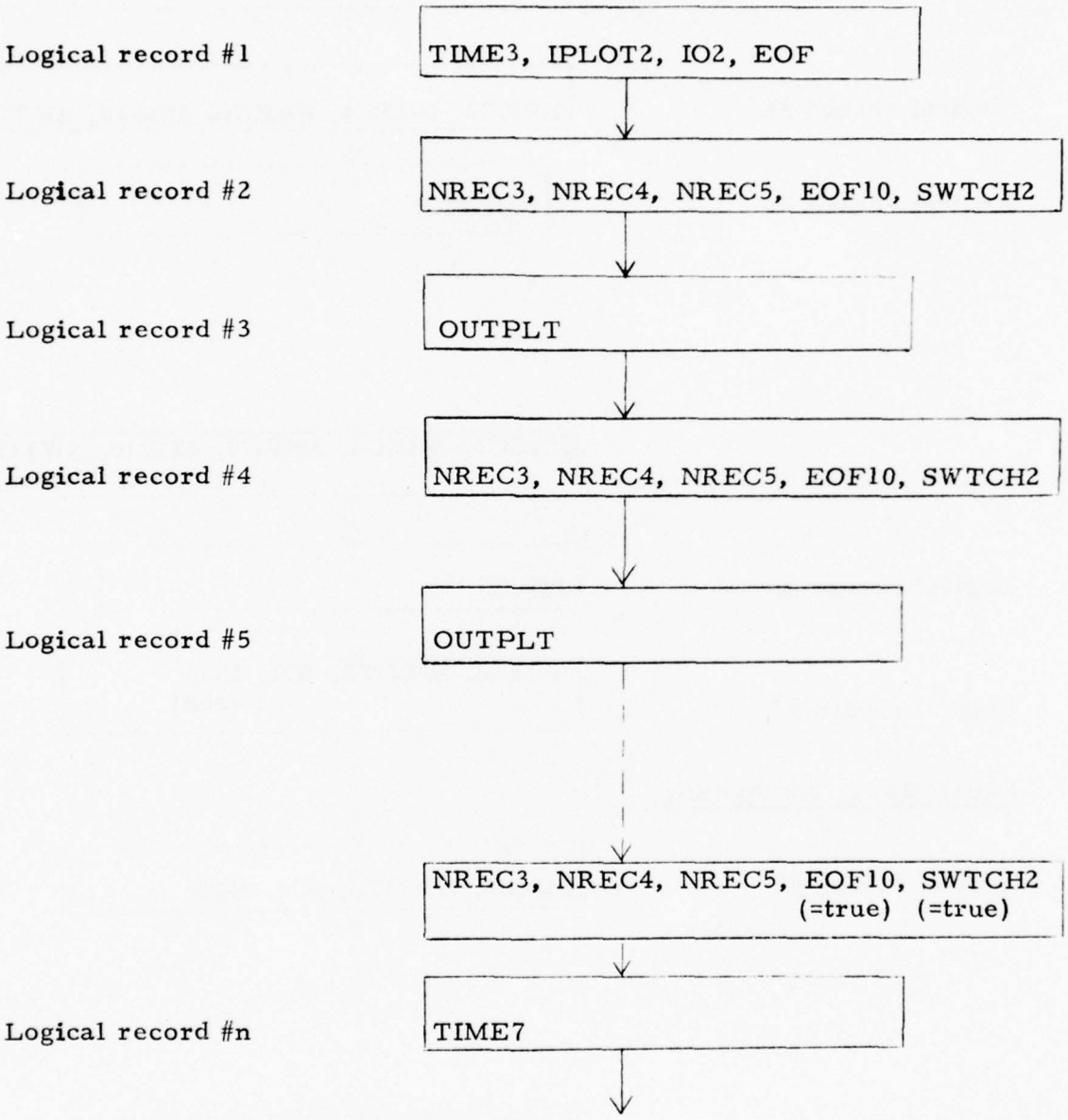

Figure III-1. Plot File Format for Each Trajectory. (1 of 2)

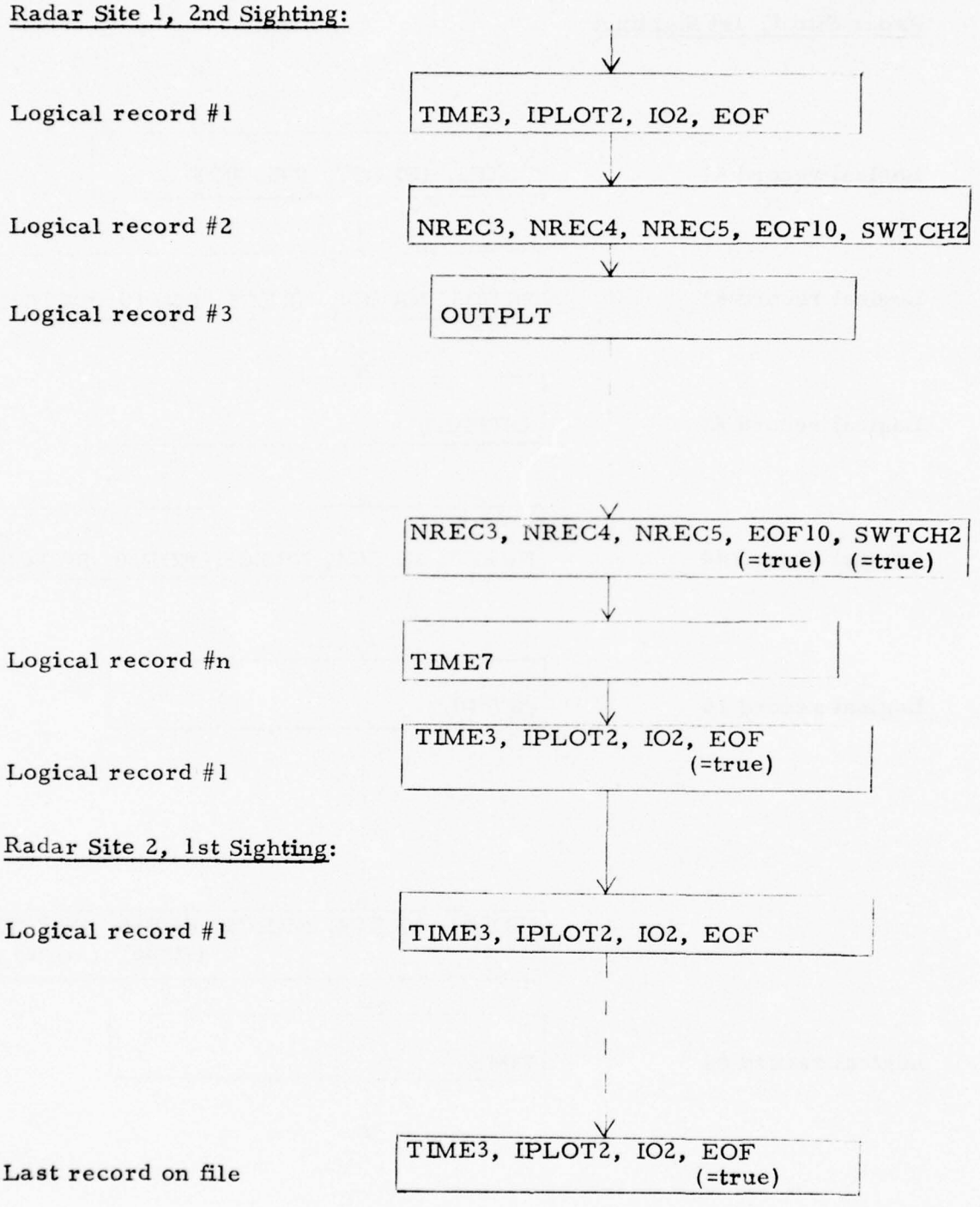

Figure III-1. Plot File Format for Each Trajectory (2 of 2)

Symbol Name	Units	Description
EOF		Switch variable to denote the end of data for the current radar site and the current trajectory.
	T	There is no more data on the file for the current site and trajectory.
	F	Radar data follows for the current site and trajectory.

Note that the description of IPLOT2 above is somewhat different from that given under Inputs. The description above is given mainly from the standpoint of a plot program.

Logical Record No. 2, 4, 6, ---

Symbol Name	Units	Description
NREC3	None	Number of time points in the radar trajectory data on the following record.
NREC4	None	Total number of time points in the following record of radar data and all previously input records of data for the current sighting of the missile trajectory by the radar.
NREC5	None	Number of the following record of radar data for the current sighting.
EOF10		Switch variable to signal the end of the set of data for the current missile sighting.
	T	No more radar data follows for the current sighting.
	F	More data follows for the current sighting.
SWTCH2		Switch variable for plot program to read last time missile is visible to the radar for the current sighting.
	T	Read in this last time from the file.
	F	Do not read in this last time from the file.

Note: In the current version of the program, NREC4 and NREC5 are not used, and the last time of missile visibility to the radar is not written on the plot file. This means SWTCH2 will always be false, and when EOF10 is true, logical record no. 2, 4, 6, --- will be the last record on the file for one sighting of the missile by the radar. The very last record on the file will be logical record no. 1 with EOF true following data for the last trajectory and final sighting by the last radar site.

Logical record no. 3, 5, 7, ---

Symbol Name	Units	Description
OUTPLT		Output array for outputting the data on this record. There are NREC3*IO2 data words on this record. The contents of OUTPLT are:
OUTPLT(1)	N.M.	Radar slant range for 1st time-point of this record.
OUTPLT(2)	Ft./Sec.	Radar slant range rate for 1st timepoint.
OUTPLT(3)	Deg.	Radar elevation angle.
OUTPLT(4)	Deg/Sec.	Radar elevation angle rate.
OUTPLT(5)	Deg.	Radar azimuth angle.
OUTPLT(6)	Deg/Sec.	Radar azimuth angle rate.
OUTPLT(7)	eru	Trajectory radius in eru.
OUTPLT(8)	Deg.	Trajectory inertial phi angle.

If IPLOT2 = .TRUE., the following parameters will also be on this logical record:

OUTPLT(9)	Ft./Sec.^{2}	Slant range acceleration.
OUTPLT(10)	Deg./Sec.^{2}	Elevation angle acceleration.
OUTPLT(11)	Deg./Sec.^{2}	Azimuth angle acceleration.
OUTPLT(12)	Deg.	Missile reentry angle.
OUTPLT(13)	Deg.	Missile heading angle.

Note: If IPLOT2 if false, there are only 8 different radar trajectory parameters on this record for each time point; if IPLOT2 is true there will be 13. Each parameter will be repeated every IO2+1 word of OUTPLT; e.g., OUTPLT (IO2+1) contains the slant range for the 2nd time point of the record, OUTPLT (IO2+2) contains the range rate for the 2nd time point, etc. Any pair of consecutive time points for any records containing radar parameter data are separated by the same increment in time. That is, the time increment between consecutive time points has been set at 0.1 min. for all radar data on the plot file.

If SWTCH2 is true (not currently allowed), the following record will be written on the file. It will be the last record on the file for one sighting of the missile by the radar site and is used mainly in the computation of radar parameter differences.

Logical record no. n

Symbol Name	Units	Description
TIME7	Min.	Last time of sighting (or detection) by the radar site for the current missile sighting.

5. Main Logic Flow

Figure III-2 is a flow chart of the main logic of the program. It is basically a flow chart for the executive (main program) of the program.

6. Sample Job Stream

The sample job stream following Figure III-2 illustrates the program setup for a 1 radar site and 8 trajectory run. The nominal trajectory for the perturbations was chosen as the 1st trajectory. The job stream is setup to place radar data on the plot file so that plots may be produced later if so desired. In the job stream, file 09 stores trajectory data and file 10 stores the radar data to be plotted. The sample output and sample plots included in this document were produced by executing this sample job stream. The output and plots herein included are for the first 3 trajectories only. Note that the second trajectory is labeled number 4. Also, the input data of the job stream causes circular orbit trajectories to be generated.

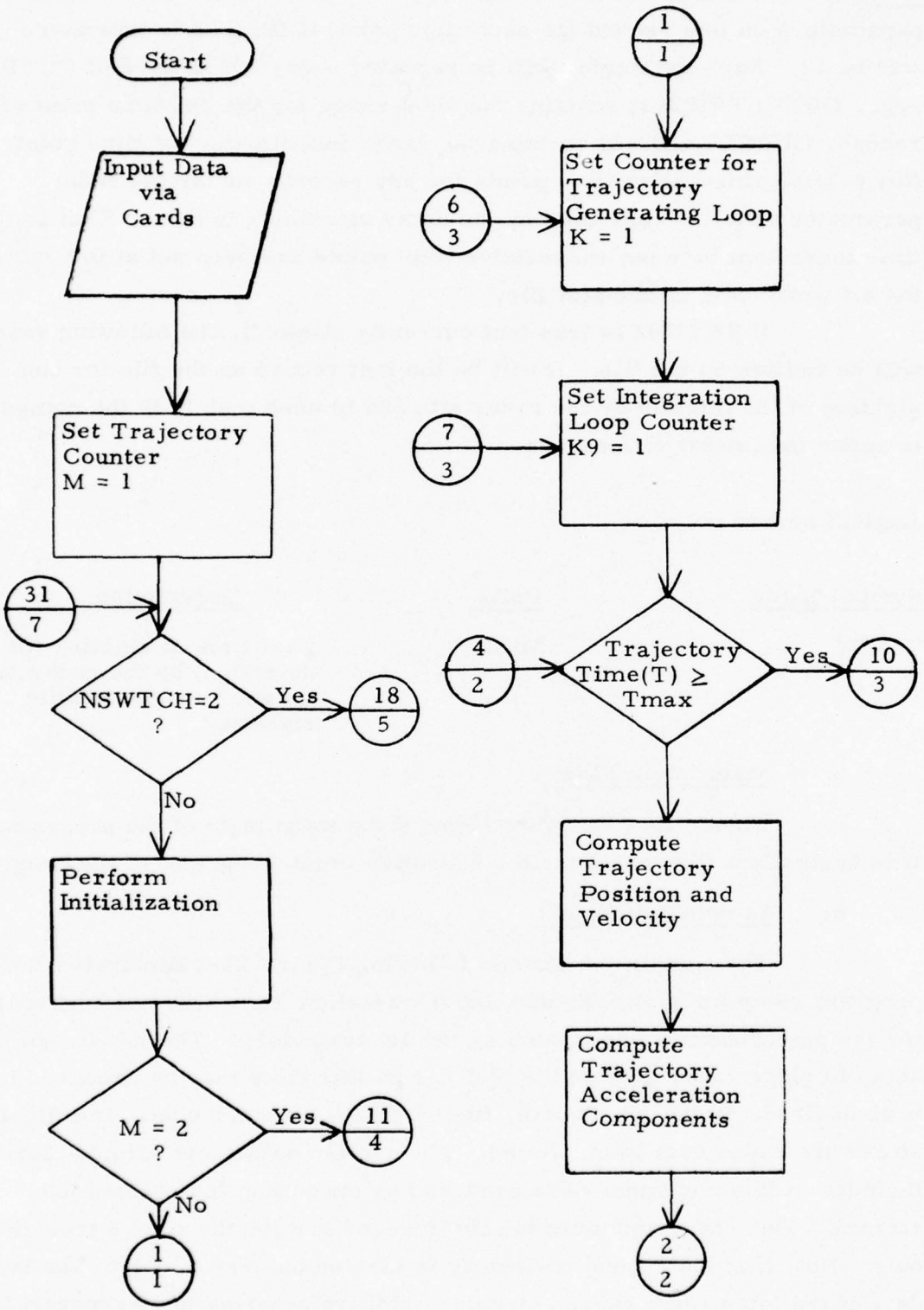

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (1 of 9)

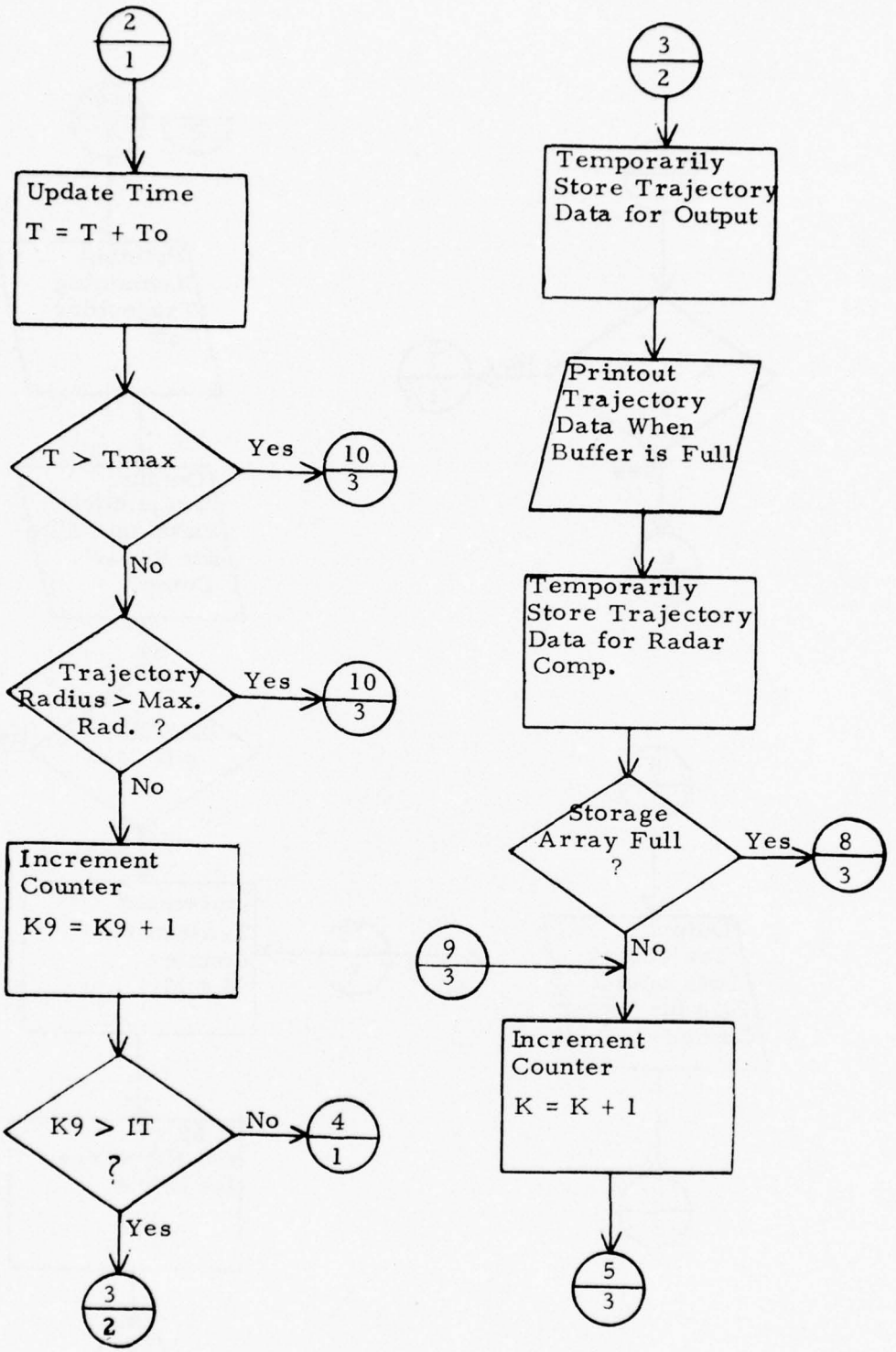

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (2 of 9)

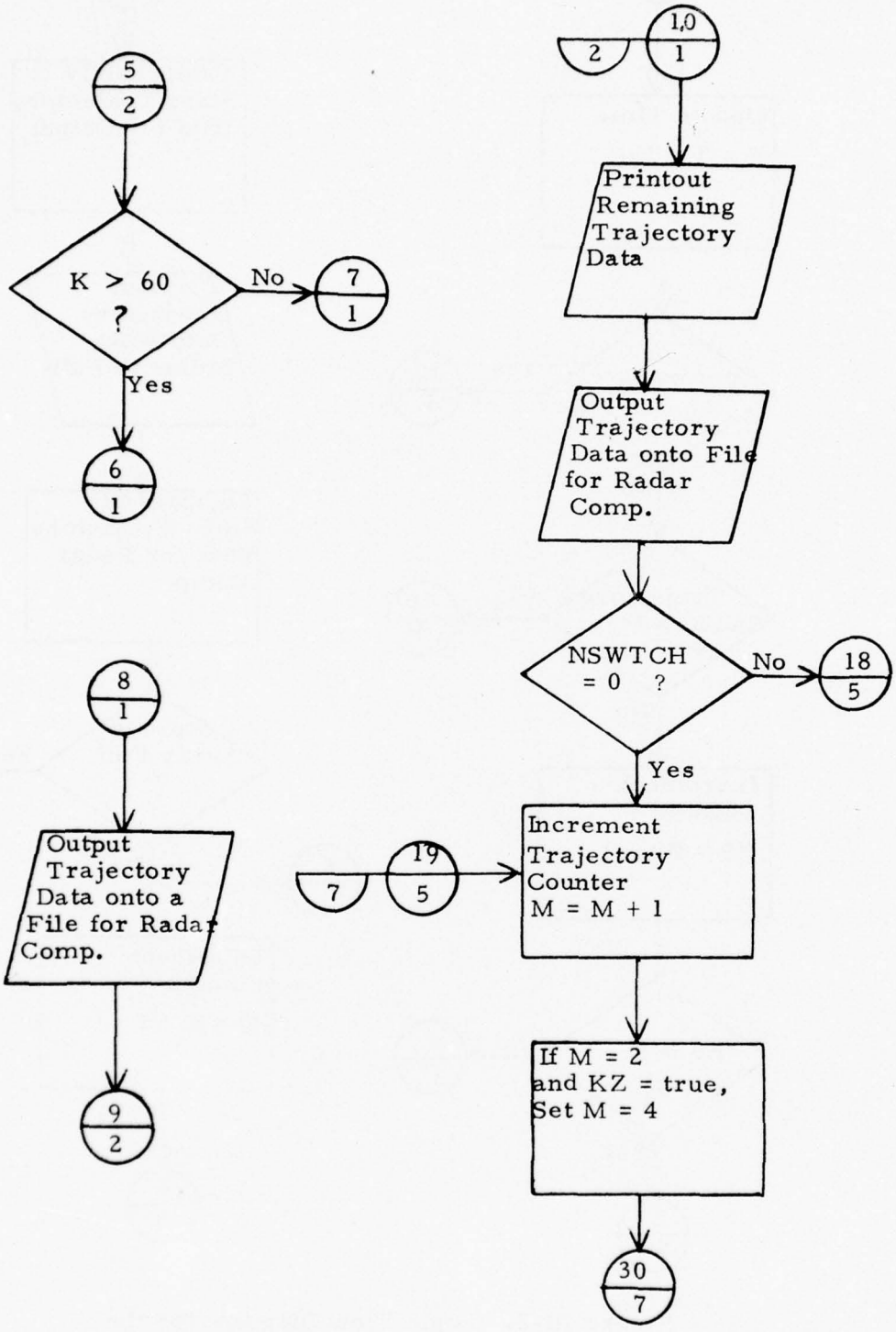

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (3 of 9)

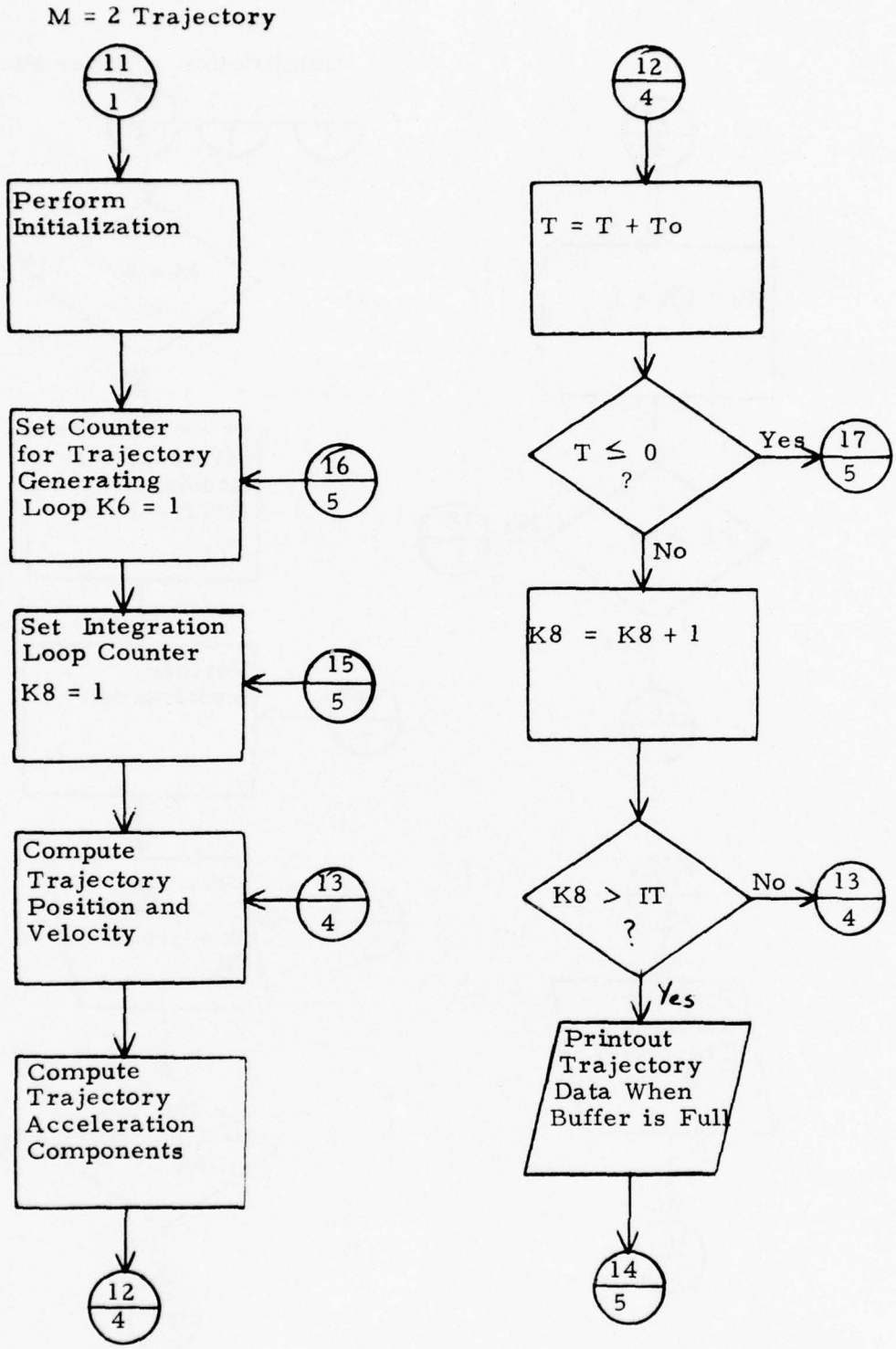

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (4 of 9)

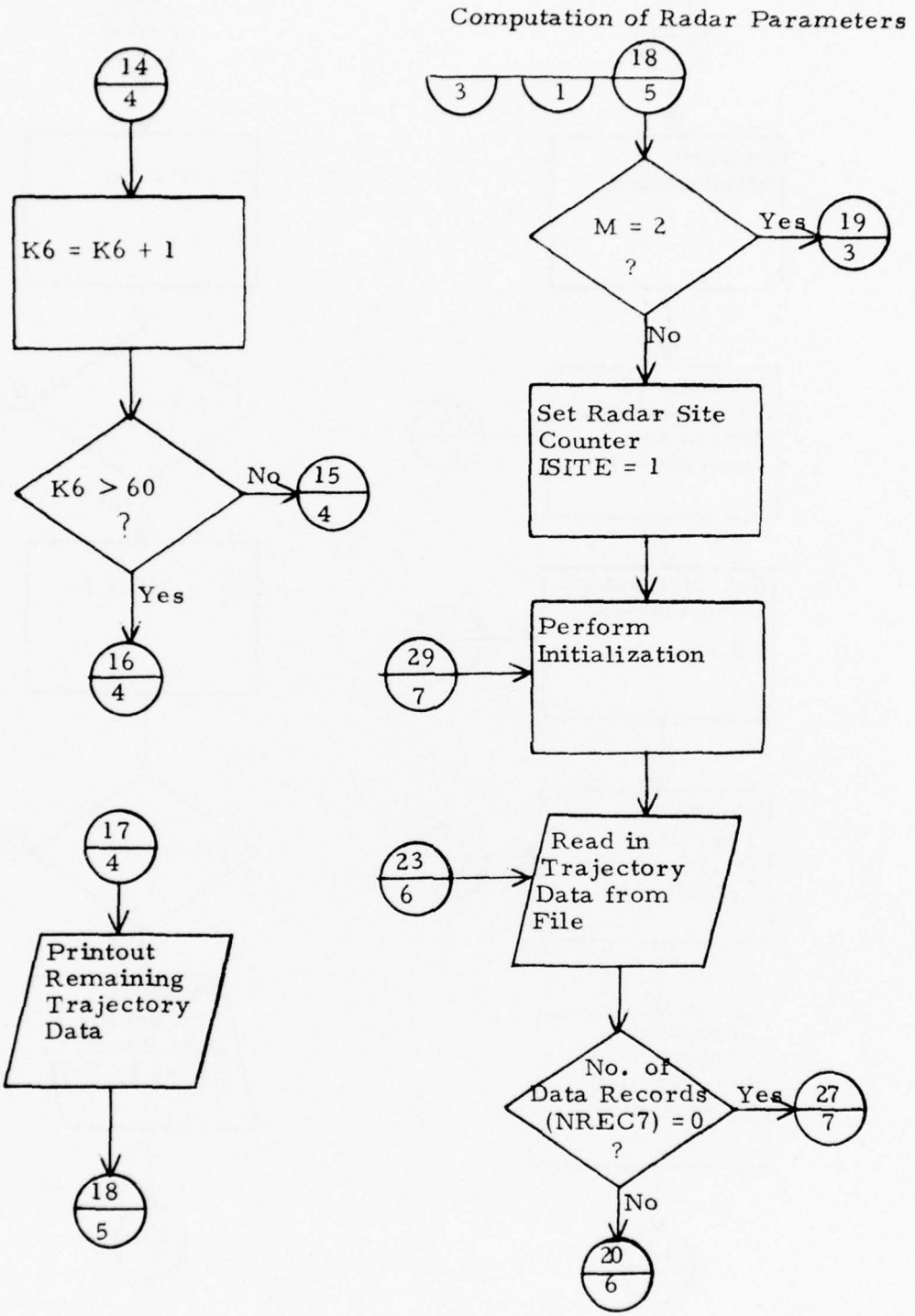

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (5 of 9)

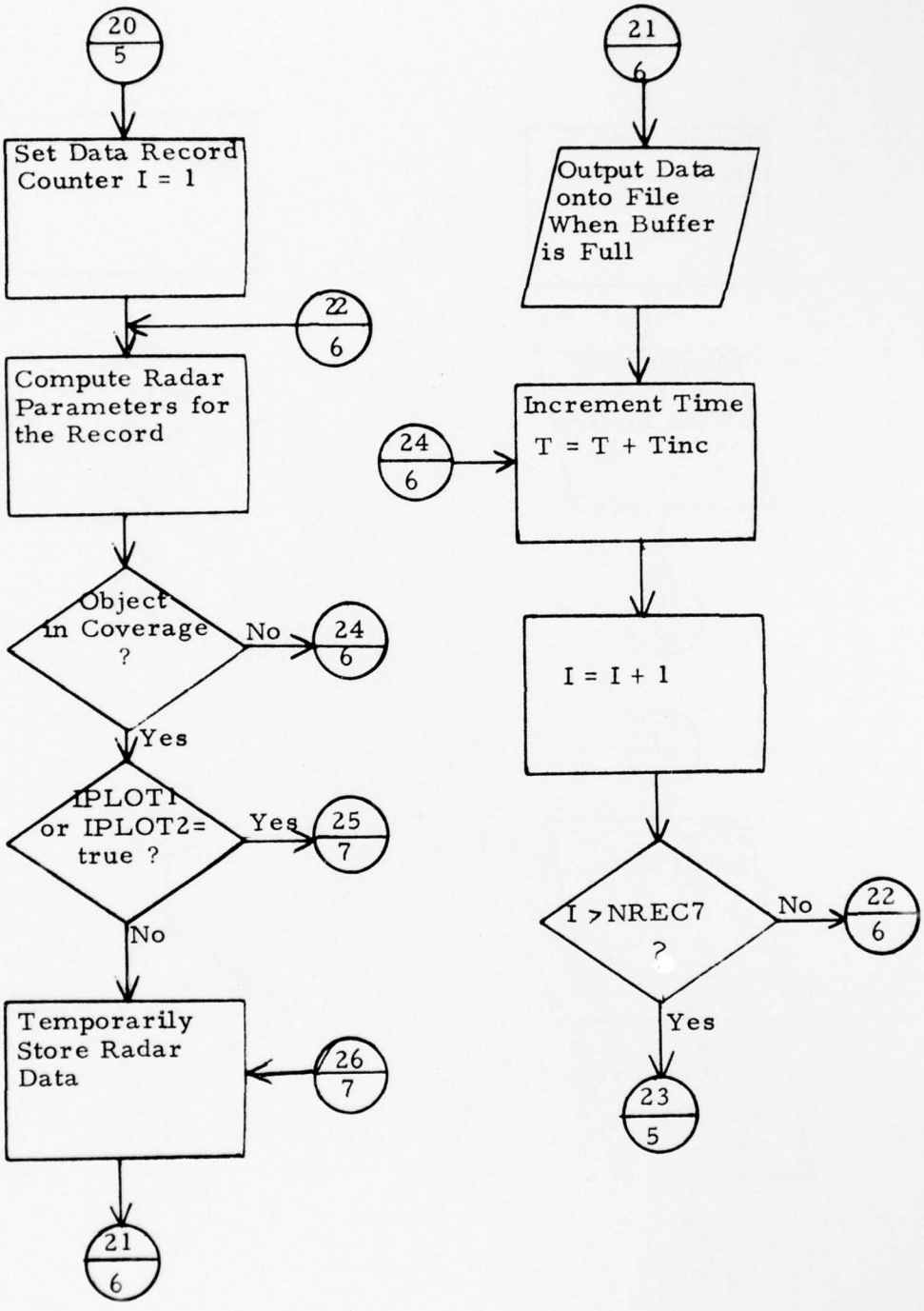

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (6 of 9)

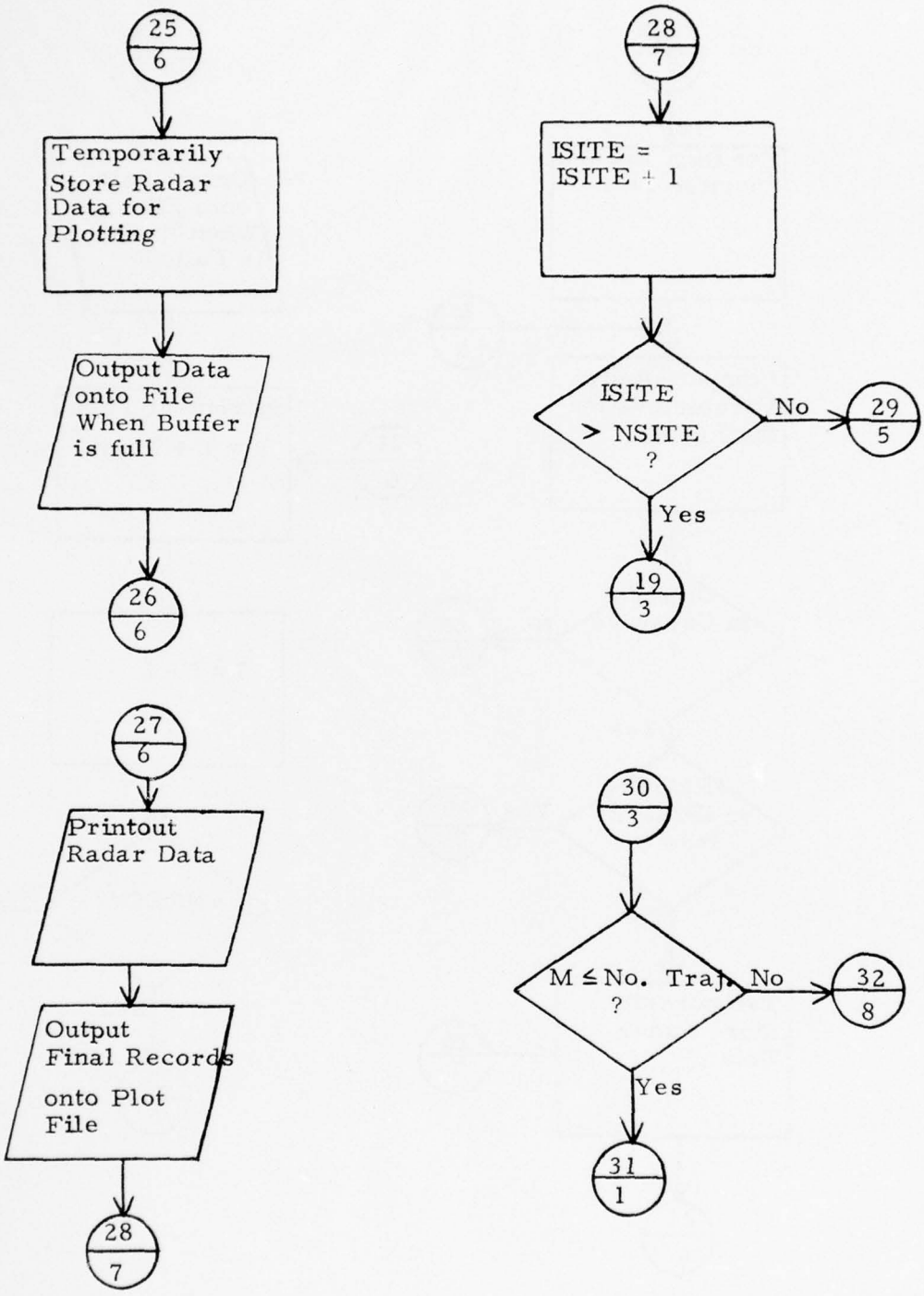

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (7 of 9)

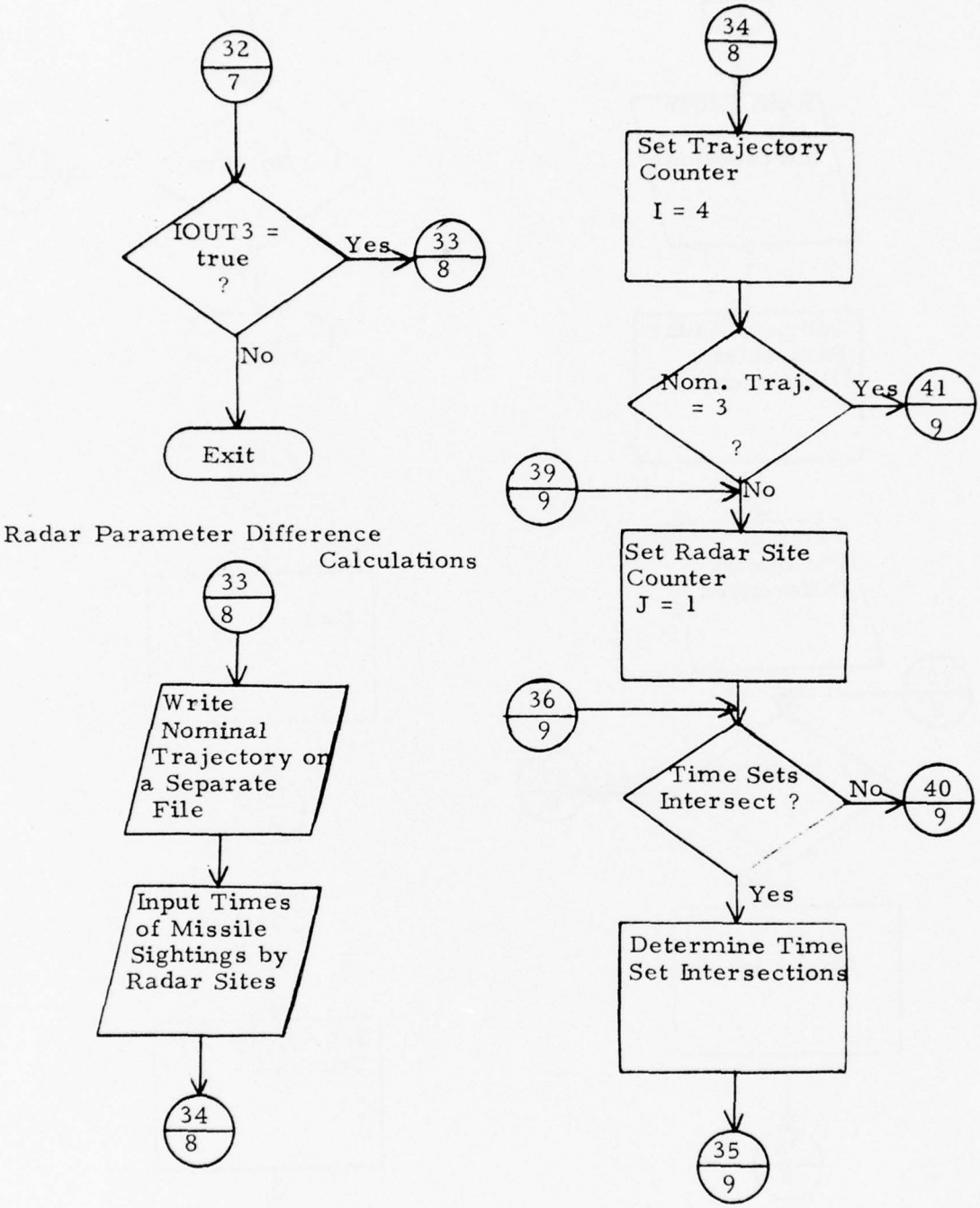

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (8 of 9)

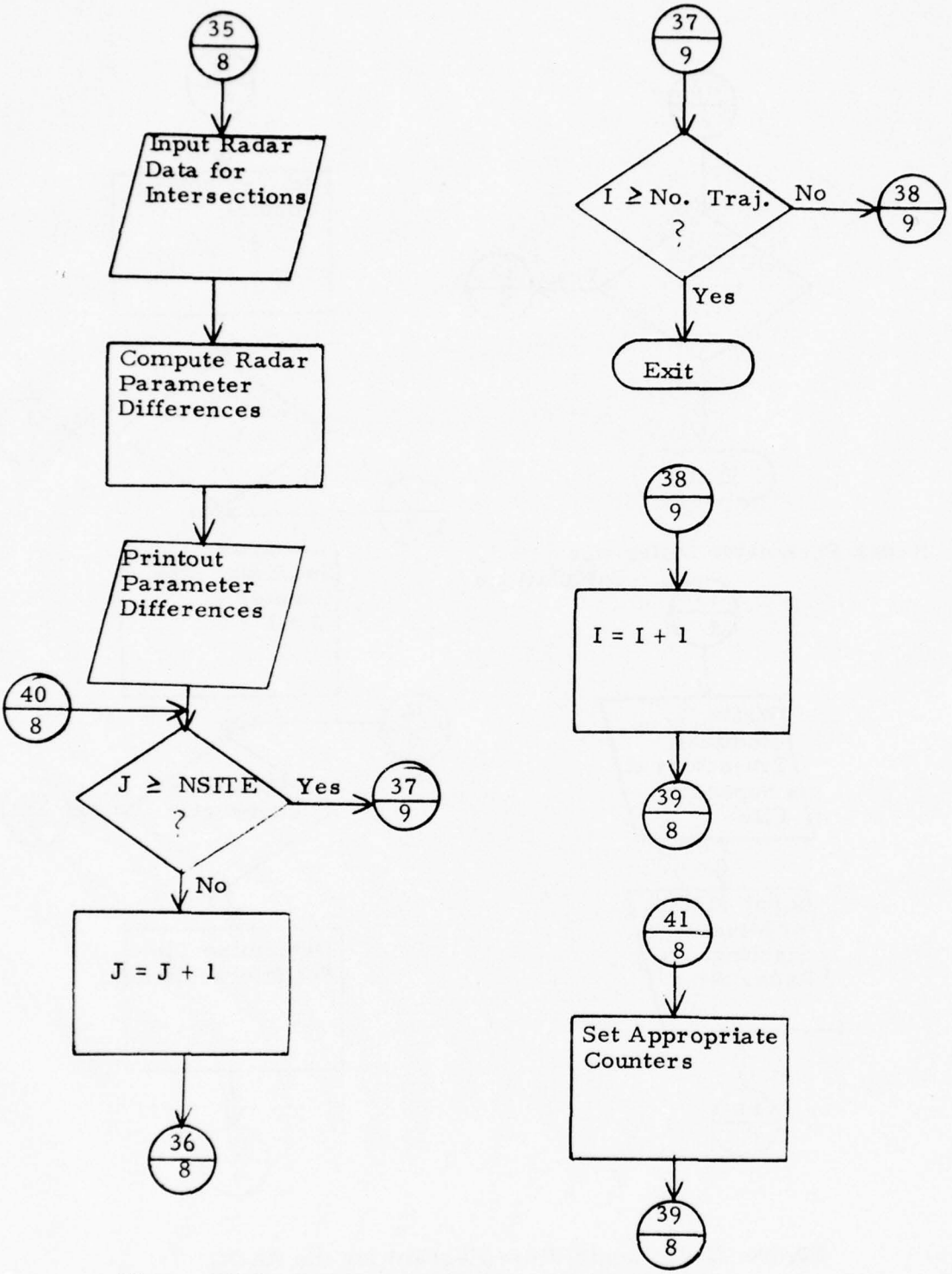

Figure III-2. Logic Flow Diagram for the RADC Trajectory Program (9 of 9)

```
10$:IDENT:CLEARY,CONTI      ,651211048ADC,DSSR
20$:USERID:CLEARYSTHREE
30$:OPTION:FORTRAN
40$:SELECT:CLEARY/OMISSATC
50$:SELECT:CLEARY/OSUBC
60$:SELECT:CLEARY/OOUTPUTC
70$:SELECT:CLEARY/OINTRAJC
75$:SELECT:CLEARY/OATMOSC
77$:SELECT:CLEARY/OFOTNXC
80$:EXECUTE
90$:LIMITS:40,40K,,12000
100$:DISC:08,A18,19L
110$:PERMFL:09,R/W,L,CLEARY/DSTORA
115$:PERMFL:10,R/W,L,CLEARY/DSTORB
120$:DATA:05
130 $INPUT1 NTRAJ=10,TM=20.0DC,NSWTCH=1 $
140 $INPUT2 IOUT1=F,IOUT2=F,IOUT3=F,OUTINC=0.1,KAT=F,KZ=T,
150 SPHERE=T,IPLOT1=T,IPLOT2=F,INERTL=T $
160 $INPUT3 GAM=90.0D0,BETA=31.82638D0,VO=2.556742D4,
170 HX=6.08028D5,THE=62.7D0,GLAM=40.35D0,THES=-40.0D0,GLAMS=60.0DC $
180 $INPUT4 NSITE=1,
190 SLAT(1)=35.0D0,SLONG(1)=233.333D0,SALT(1)=0.0D0,ELIM=89.0D0 $
200 $INPUT5 A(1)=4*0.0D0,5.0D0,2*3.533DC,
210 B(1)=0.0D0,5.0D0,3.533D0,-3.533D0,3.0D0,3.533DC,-3.533D0,
204 C(1)=5.0D0,0.0DC,2*3.533D0,3*0.0D0 $
210$:ENDJOB
220***EOF
```

Sample Job Stream for the RADC Trajectory Program

RADC 635/645 BATCH JOB

SNUMB NUMBER	DATE	TIME
	7/2/76	1330
PROGRAMMER: Conti	TELEPHONE: 339-1360	
RADC ENGINEER: Cleary	TELEPHONE: 3573	SYMBOL: OCSA

TAPES ASSIGNED

REEL NO.	WRITE	READ	DEN.	TITLE
None				

PERIPHERALS ASSIGNED
[X] READER [X] PRINTER [ ] PUNCH
[X] DISC # OF LINKS 40 [ ] DRUM # OF LINKS ____

CORE SIZE 40K	ACTIVITIES 1
PROCESSOR TIME 0.10	ESTIMATED LINES OF PRINT 5,000
TOTAL RUN TIME 0.25	

DECKS EXPECTED

NO. OF BINARY DECKS	NO. OF COMDECKS
None	

BMC | TAPE [ ] DUMP [ ] COPY

FROM:	TO:	MODE [ ] BCD [ ] BINARY	NO. OF FILES

SPECIAL OPERATOR INSTRUCTIONS

(Use reverse side if required)

RADC FORM APR 69 0-56 PREVIOUS EDITION WILL BE USED

HIS 6000 Batch Submittal Form

Source Listing of the RADC Trajectory Program

```
C MISSAT     MISSILE/SATELLITE TRAJECTORY PROGRAM                          00000010
C      INPUT/OUTPUT MOD 2,MULTIPLE SITE/TRAJECTORY VERSION                 00000020
                                                                           00000030
                                                                           00000040
C      THIS IS A GENERAL PERTURBATION PROGRAM THAT PREDICTS THE POSITION,   00000050
C      VELOCITY, AND ACCELERATION OF A VEHICLE WHETHER AS AN EARTH         00000060
C      ORBITING SATELLITE OR BALLISTIC MISSILE.THE FORMULATION IS BASED    00000070
C      UPON THE NUMERICAL INTEGRATION OF THE SPHERICAL FORM OF THE EARTH.   00000080
C      THE 1959 ARDC ATMOSPHERIC MODEL AND                                 00000090
C      THE EARTH WIND ARE INCLUDED.                                        00000100
                                                                           00000110
C      THIS ROUTINE DRIVES THE PROGRAM.                                    00000120
C      THE MAIN SUBROUTINE GROUPINGS CALLED ARE                            00000130
C        1. EQTNX - COMPUTES ACCELERATION COMPONENTS                       00000140
C        2. CONVER - COMPUTES SENSOR PARAMETERS                            00000150
C        3. RKG - USING A 4TH ORDER RUNGE KUTTA-GILL, NUMERICALLY          00000160
C      INTEGRATES THE EQUATIONS OF MOTION                                  00000170
                                                                           00000180
C     ALL DATA ASSOCIATED WITH THE MATHEMATICAL MODEL OF THE EARTH ARE     00000190
C      FROM MAKEMSON,B. , BAKER,R.L.M. , AND WESTRON,G.B. ANALYSIS AND     00000200
C      STANDARDIZATION OF ASTRODYNAMIC CONSTANTS.                          00000210
                                                                           00000220
       DOUBLE PRECISION X,XD,XDD,TO,TM                                     00000230
        DOUBLE PRECISION TC,TI,XK,TX                                       00000240
      *,T,H,XYZ,RSL,PZ,R,W                                                 00000250
       DOUBLE PRECISION TN,STN                                             00000260
       DOUBLE PRECISION P1,ZK,B1,GEO                                       00000270
       DOUBLE PRECISION GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AH,THES,GLAMS      00000280
      *,E,ELIM,SLAT,SLONG,SALT                                             00000290
       COMMON/E/E/ELIM/ELIM/IJJ/INOM,I,J,JSIGHT,TSTART,TEND                00000300
       COMMON/MS/ GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AH,THES,GLAMS            00000310
       COMMON/TS/T,H,XYZ,RSL,PZ                                            00000320
      *7A/R,W/JX/JX/TIME2/TIME2                                             00000330
       COMMON/BS/ X(3), XD(3), XDD(3)                                      00000350
      *7GEOXK/GEO,XK                                                       00000370
      *7SWSW/SWTCH1,SWTCH2/SW10/SWCH10                                     00000380
      *7SW3SW4/SWTCH3,SWTCH4                                               00000390
      *7SW5SW6/SWTCH5,SWTCH6                                               00000400
      *7SW7/SWTCH7/SW8/SWTCH8/SW9/SWTCH9/NSWTCH/NSWTCH                     00000410
      *7TIME5/TIME5                                                        00000420
      *7TSIGHT/TIMESI(10,10,5),TIMESW(10,10,5),NSIGHT(10,10)               00000425
      *7OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC,IOUT3        00000430
      *7OUTRJ/OUTRJ(5000),OUTRAD(5000),OUTPLT(5000)                        00000440
      *7NTRAJ/ITM                                                          00000450
       COMMON/GE/ZK,B1,P1                                                  00000460
       COMMON/AX/TM,M                                                      00000470
       COMMON/INOUT/INCOUT,IOUT,NOFF1,NOFF2,NOFF3,IOUTA                    00000480
      *7TO/TO/IT2/IT2,IT                                                   00000490
       COMMON/NR/NREC1,NREC2,NREC3,NREC4,NREC5,NREC                        00000500
      *7IO/IO,IO1,IO2                                                      00000510
       COMMON/NR7/NREC7,NOFF4                                              00000520
      *7ISITE/ISITE/SITES/NSITE,SLAT(20),SLONG(20),SALT(20)                00000530
```

```
      LOGICAL IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE                   00000540
     *,IOUT3,SWTCH1,SWTCH2,SWCH10                                       00000550
      LOGICAL SWTCH3,SWTCH4                                             00000560
      LOGICAL SWTCH5,SWTCH6                                             00000570
     *,SWTCH7,SWTCH8,SWTCH9                                             00000580
                                                                        00000600
C     INPUT DATA                                                        00000610
                                                                        00000620
      CALL INPUT                                                        00000630
                                                                        00000640
      M=1                                                               00000650
                                                                        00000660
C     SET INTEGRATION STEP SIZE AND NUMBER OF INTEGRATION STEPS         00000670
                                                                        00000680
  260 TO=0.1D-1                                                         00000690
      IT=10                                                             00000700
      TINC=TO*IT                                                        00000705
      IF(NSWTCH.EQ.2)GO TO 250                                          00000707
                                                                        00000710
C     INITIALIZATION                                                    00000720
                                                                        00000730
      CALL INITAL                                                       00000740
                                                                        00000750
C     INITIALIZE MISSILE/SATELLITE TRAJECTORY                           00000760
                                                                        00000770
      CALL ICERBM                                                       00000780
      IF(M.EQ.2)GO TO 1 5                                               00000790
      CALL EQTNX                                                        00000800
  105 CALL OUTPUT                                                       00000810
      IF(M.EQ.2)GO TO 6                                                 00000860
      CALL STORTR                                                       00000865
                                                                        00000890
C      MAIN PROCESSING LOOP FOR TRAJECTORY GENERATION                   00000900
                                                                        00000910
20    DO 16 K=1,60                                                      00000920
                                                                        00000930
C     INTEGRATION LOOP                                                  00000940
                                                                        00000950
      DO 1 K9=1,IT                                                      00000960
      IF(T.GE.TM-1. D-5)GO TO 21                                        00000970
                                                                        00000980
C     PERFORM RUNGE-KUTTA INTEGRATION                                   00000990
                                                                        00001000
      CALL RKG                                                          00001010
                                                                        00001030
C     COMPUTE ACCELERATION COMPONENTS                                   00001040
                                                                        00001050
      CALL EQTNX                                                        00001060
      T=T+TO                                                            00001065
      IF(T.GT.(TM+1.0D-5).OR.Y(7).GT.GEO)GO TO 21                       00001070
    1 CONTINUE                                                          00001080
      IOUT = IOUT + IT                                                  00001090
```

```
C     STORE TRAJECTORY DATA FOR OUTPUT                                  00001100
                                                                        00001110
                                                                        00001120
      IF(IOUT.GE.INCOUT)CALL STORTJ                                     00001130
                                                                        00001140
C     PRINT OUT TRAJECTORY DATA                                         00001150
                                                                        00001160
      IF(NREC1.GE.NOFF1)CALL PRINTT                                     00001170
                                                                        00001180
                                                                        00001190
C     STORE TRAJECTORY DATA FOR RADAR COMPUTATIONS                      00001200
                                                                        00001210
      CALL STORTR                                                       00001220
      IF(NREC7.GE.NOFF4)GO TO 150                                       00001230
      GO TO 16                                                          00001240
                                                                        00001250
C     OUTPUT TRAJECTORY DATA ON A FILE                                  00001260
                                                                        00001270
  150 IF(SWTCH9)CALL OUTTRI                                             00001280
      SWTCH9=.FALSE.                                                    00001290
      CALL OUTTR                                                        00001300
   16 CONTINUE                                                          00001310
      GO TO 20                                                          00001320
   21 IF(X(1).GT.GEO)GO TO 2                                            00001325
      SWTCH3=.TRUE.                                                     00001330
    2 CONTINUE                                                          00001340
                                                                        00001350
C     PRINT OUT TRAJECTORY DATA                                         00001360
                                                                        00001370
      CALL PRINTT                                                       00001380
                                                                        00001390
C     OUTPUT TRAJECTORY DATA ON A FILE                                  00001400
                                                                        00001410
      IF(SWTCH9)CALL OUTTRI                                             00001415
      IF(NREC7.NE.0)CALL OUTTR                                          00001420
      CALL OUTTR                                                        00001430
      IF(ITM.GE.2)CALL STORT2                                           00001431
      IF(NSWTCH.EQ.1)GO TO 17                                           00001432
      GO TO 25                                                          00001435
   60 CONTINUE                                                          00001440
C                                                                       00001450
C      M = 2 TRAJECTORY                                                 00001460
C                                                                       00001470
C     SET INTEGRATION STEP SIZE AND NUMBER OF STEPS                     00001480
C                                                                       00001490
      TO=-0.01D0                                                        00001500
      IT=10                                                             00001510
      IF(SWCH10)IT=IT2                                                  00001520
      DO 41 K8=1,IT                                                     00001530
      CALL RKG                                                          00001540
      CALL EQTNX                                                        00001550
      T=T+TO                                                            00001560
```

```
      IF(T.LE.1.0D-5)GO TO 86                                          00001570
   41 CONTINUE                                                         00001580
      TIME2=T                                                          00001585
      CALL STORTJ                                                      00001590
      IF(SWCH10)IT=10                                                  00001600
C                                                                      00001610
CC     MAIN PROCESSING LOOP,M=2 TRAJECTORY                             00001620
C                                                                      00001630
   70 DO 18 K6=1,60                                                    00001640
      DO 40 K8=1,IT                                                    00001650
      CALL RKG                                                         00001660
      CALL EQTNX                                                       00001670
      T=T+TO                                                           00001680
      IF(T.LE.1.0D-5)GO TO 86                                          00001690
   40 CONTINUE                                                         00001700
      IOUT=IOUT+IT                                                     00001710
      IF(IOUT.GE.INCOUT)CALL STORTJ                                    00001720
      IF(NREC1.GE.NOFF1)CALL PRINTT                                    00001730
   18 CONTINUE                                                         00001740
      GO TO 70                                                         00001750
   86 SWTCH3=.TRUE.                                                    00001760
      CALL PRINTT                                                      00001770
C                                                                      00002000
CC     COMPUTE RADAR PARAMETERS                                        00002010
C                                                                      00002020
  250 IF(M.EQ.2)GO TO 17                                               00002025
      DO 500 ISITE=1,NSITE                                             00002030
      CALL INITAL                                                      00002040
C                                                                      00002060
CC     INPUT TRAJECTORY DATA                                           00002070
C                                                                      00002080
      CALL INTRAJ                                                      00002090
  100 CALL TRAJIN                                                      00002100
      IF(NREC7.EQ.0)GO TO 200                                          00002110
      JX=1                                                             00002120
      DO 300 I=1,NREC7                                                 00002130
      CALL TRAJX                                                       00002140
      CALL CONVER                                                      00002160
      SWTCH5=.TRUE.                                                    00002170
      IF(E.GT.ELIN)GO TO 120                                           00002180
      SWTCH5=.FALSE.                                                   00002190
      SWTCH6=.FALSE.                                                   00002200
      IOUTA=IOUTA+IT                                                   00002210
      IF(SWTCH1)GO TO 115                                              00002220
      IF(SWTCH4)CALL STRAD2                                            00002230
  130 IF(IPLOT1.OR.IPLOT2)GO TO 135                                    00002240
C                                                                      00002250
CC     STORE RADAR DATA FOR OUTPUT                                     00002260
C                                                                      00002270
  110 IF(SWTCH4)GO TO 120                                              00002280
      IF(IOUTA.GE.INCOUT)CALL STORD1                                   00002290
      IF(NREC2.GE.NOFF2)CALL OUTRDR                                    00002300
```

```
C                                                                       00002310
  120 IF(SWTCH6)GO TO 125                                               00002320
      IF(.NOT.SWTCH1.AND.SWTCH5)GO TO 140                               00002330
      GO TO 125                                                         00002340
C                                                                       00002350
C      STORE OUTPUT DATA FOR LAST VISIBLE POINT                         00002360
C                                                                       00002370
  140 SWTCH6=.TRUE.                                                     00002380
      CALL STRADL                                                       00002390
      IF(NREC2.NE.0)CALL OUTRDR                                         00002400
      CALL OUTEOF                                                       00002410
C                                                                       00002420
C      RE-INITIALIZE SWITCHES                                           00002430
C                                                                       00002440
      SWTCH1=.TRUE.                                                     00002450
      SWTCH4=.TRUE.                                                     00002460
      IF(IPLOT1.OR.IPLOT2)GO TO 145                                     00002470
      GO TO 125                                                         00002480
C                                                                       00002490
C       OUTPUT DATA ON PLOT FILE UP TO LAST VISIBLE POINT               00002500
C                                                                       00002510
  145 SWTCH2=.TRUE.                                                     00002520
      IF(NREC3.NE.0)CALL PLTAP1                                         00002530
      CALL PLTAP2                                                       00002540
      GO TO 125                                                         00002550
C                                                                       00002560
  135 IF(SWTCH2)CALL PLTAPE                                             00002570
      SWTCH2=.FALSE.                                                    00002580
      SWTCH7=.FALSE.                                                    00002590
C                                                                       00002600
C      STORE RADAR DATA FOR PLOTTING                                    00002610
C                                                                       00002620
      CALL STORTP                                                       00002630
C                                                                       00002640
C      OUTPUT DATA ON PLOT TAPE/FILE                                    00002650
C                                                                       00002660
      IF(NREC3.GE.NOFF3)CALL PLTAP1                                     00002670
      GO TO 110                                                         00002680
  115 SWTCH1=.FALSE.                                                    00002690
      SWTCH8=.FALSE.                                                    00002700
      CALL STORAD                                                       00002710
      GO TO 130                                                         00002720
  125 CONTINUE                                                          00002730
      T=T+TINC                                                          00002740
  300 CONTINUE                                                          00002750
      GO TO 100                                                         00002760
C                                                                       00002770
C      PRINT OUT RADAR DATA                                             00002780
C                                                                       00002790
  200 CONTINUE                                                          00002800
      IF(NREC7.EQ.0)T=T-TINC                                            00002810
      IF(.NOT.SWTCH6)GO TO 23                                           00002820
```

```
   24 IF(NREC2.NE.0)CALL OUTRDR                                          00002830
      CALL OUTRDR                                                        00002840
      CALL PRINTR                                                        00002850
      IF(SWTCH8)CALL NOTVIS                                              00002860
      IF(SWTCH7)GO TO 500                                                00002870
C                                                                        00002880
C      OUTPUT LAST RECORDS ON PLOT TAPE/FILE                             00002890
C                                                                        00002900
      IF(SWTCH2)GO TO 22                                                 00002910
      IF(NREC3.NE.0)CALL PLTAP1                                          00002920
      CALL PLTAP2                                                        00002930
      CALL PLTAP3                                                        00002940
      GO TO 500                                                          00002950
   22 CONTINUE                                                           00002960
      CALL PLTAP3                                                        00002970
      GO TO 500                                                          00002980
   23 IF(T.LT.TIME5+0.01)GO TO 24                                        00002990
      CALL CONVER                                                        00003000
      IF(E.GT.ELIM)GO TO 24                                              00003010
      CALL STRADL                                                        00003020
      GO TO 24                                                           00003030
  500 CONTINUE                                                           00003040
   17 M=M+1                                                              00003045
      IF(M.EQ.2.AND.KZ)M=4                                               00003046
      IF(M.LE.ITM)GO TO 25                                               00003047
      IF(IOUT3)GO TO 1000                                                00003050
 1010 STOP                                                               00003060
C                                                                        00003070
C    COMPUTE RADAR PARAMETER DIFFERENCES                                 00003080
C                                                                        00003090
C    WRITE NOMINAL TRAJECTORY ON A SEPARATE FILE                         00003095
C                                                                        00003096
 1000 CALL OUTNOM                                                        00003100
C                                                                        00003106
C    READ AND STORE TIMES OF SIGHTING                                    00003110
C                                                                        00003120
      CALL TIMEST                                                        00003130
C                                                                        00003135
C   MAIN PROCESSING LOOP PARAMETER DIFFERENCES                           00003140
C                                                                        00003150
      INOM = 1                                                           00003160
      I=4                                                                00003170
      IPASS=1                                                            00003180
      IF(.NOT.KZ)I=1                                                     00003190
      IF (.NOT.KZ)INOM=3                                                 00003200
C                                                                        00003204
C   LOOP ON SITES                                                        00003205
C                                                                        00003206
 1060 J=1                                                                00003210
 1040 II=NSIGHT(INOM,J)                                                  00003220
      IF(TIMEST(I,J,1).GT.TIMESF(INOM,J,II))GO TO 1020                   00003230
      II=NSIGHT(I,J)                                                     00003240
```

```
      IF(TIMESI(INOM,J,1).GT.TIMESF(I,J,II))GO TO 1020                  00003250
C                                                                       00003260
C     DETERMINE THE INTERSECTIONS OF TIME SETS                          00003270
C                                                                       00003280
      CALL INTER                                                        00003290
C                                                                       00003300
C     INPUT RADAR DATA CORRESPONDING TO TIME SET INTERSECTIONS           00003310
C                                                                       00003320
      CALL INTDAT                                                       00003330
 1020 IF(J.GE.NSITE)GO TO 1030                                          00004000
      J=J+1                                                             00004010
      GO TO 1040                                                        00004020
 1030 IF(I.GE.ITM)STOP                                                  00004030
      IF(INOM.EQ.1)GO TO 1 50                                           00004040
      IF(IPASS.NE.1)GO TO 1050                                          00004050
      IPASS=2                                                           00004060
      I=3                                                               00004070
 1050 I=I+1                                                             00004080
      GO TO 1060                                                        00004090
      END                                                               00004100
***EOF                                                                  00005010
```

```
      CATMOSP      ATMOSPHERIC MODEL
            SUBROUTINE ATMOSP
      C     THIS ROUTINE COMPUTES THE ATMOSPHERIC DENSITY(IN SLUGS PER FEET
      C     CUBED) FROM THE 1959 ARDC MODEL ATMOSPHERE.ABOVE 105 KILOMETERS
      C     THE DENSITY IS SET EQUAL TO ZERO. BELOW THIS VALUE, THE LAYERS
      C     ASSUME AN ISOTHERMAL OR LINEAR TEMPERATURE LAPSE RATE SECTION.

            DOUBLE PRECISION HP,H2P,SK3,HB,PB,SK1,SK2,CD,ST
            DOUBLE PRECISION P1,ZK,B1
            DOUBLE PRECISION TS,T,H,V,RSL,PZ,XYZ
            COMMON/TS/T,H,XYZ,RSL,PZ
            COMMON/GE/ZK,B1,P1
            HP=.3048D0*H
            H2P=HP/(1.0D0+HP/.6356766D7)
            IF(HP-5.3D4)20,25,25
         20 IF(HP-4.7D4)21,29,29
         21 IF(HP-2.5D4)22,30,30
         22 IF(HP-1.1D4)23,31,31
         23 IF(HP)28,28,32
         25 IF(HP-7.9D4)33,33,26
         26 IF(HP-9.0D4)34,34,27
         27 IF(HP-1.05D5)35,35,28
         28 PZ=0.0D0
            Q1=0.0D0
            Q2=0.0D0
            Q3=0.0D0
            RETURN
         29 SK3=.120869D-3
            HB=4.7D4
            PB=2.8804D-6
            GO TO 37
         30 SK1=.138466D-4
            SK2=1.13883D1
            PB=7.765D-5
            HB=2.5D4
            GO TO 36
         31 SK3=.157689D-3
            HB=1.1D4
            PB=7. 62D-4
            GO TO 37
         32 SK1=- .225569D-4
            SK2=-5.25612D0
            PB=2.37692D-3
            HB=0.0D0
            GO TO 36
         33 SK1=-1.159202D-4
            SK2=-7.59218D0
            PB=1.39468D-6
            HB=5.3D4
            GO TO 36
         34 SK3=.206234D-3
            HB=7.9D4
```

```
      PB=4.1189D-8
      GO TO 37
   35 SK1=.241458D-4
      SK2=8.9492D0
      PB=4.261D-9
      HB=9.0D4
   36 CD=1.0D0+SK1*(H2P-HB)
      ST=-(1.0D0+SK2)
      PZ=  PB*(CD**ST)
      RETURN
   37 PZ=PB*DEXP(-SK3*(H2P-HB))
      RETURN
      END
```

```
      CBALCOF     BALLISTIC COEFFICIENTS
            SUBROUTINE BALCOF
             DOUBLE PRECISION   Z1,Z2,Z3,Z4,Z5,B1,ZK
            DOUBLE PRECISION HB,HB2,HB3,HB4,P1,P2,P3,P4
            DOUBLE PRECISION XL1,XL2,XL3,XL4,XL5
            DOUBLE PRECISION GM,TM,X,T,H,XYZ,RSL,PZ
            DOUBLE PRECISION XD,XDD
            DOUBLE PRECISION P5,P7,P9,P11,P13,P14,P8
            COMMON/BS/X(3),XD(3),XDD(3)
            COMMON/AX/TM,M/TS/T,H,XYZ,RSL,PZ
            COMMON/GE/ZK,B1,P1
            DATA GM/1.407639D16/
            HB = H*1.D-3
            IF (HB.GE.3.445D2) GO TO 90
            HB2 = HB*HB
            HB3 = HB2*HB
            HB4 = HB2*HB2
            IF(M.LE.3) GO TO 3
            IF(M.EQ.4) GO TO 4

      C     ******** M = 3   RV-9-2B   ********

        3   P1 = 0.0D0
            P2 = 9.0D1
            P3 = 1.8D2
            P4 = 2.7D2
            IF(HB.GE.P4)GO TO 18
            IF(HB.GE.P3) GO TO 20
            IF(HB.GE.P2) GO TO 22
            IF(HB.GE.P1) GO TO 24
            GO TO 90
       18   XL1 = .8473D-7
            XL2 = .3864D-5
            XL3 = -.4263D-1
            XL4 = .1417D+2
            XL5 = -.1124D+4
            GO TO 2
       20   XL1 = .2573D-6
            XL2 =-.4352D-4
            XL3 = -.4597D-1
            XL4 = .1253D+2
            XL5 =-.4204D+3
            GO TO 2
       22   XL1 = -.1944D-5
            XL2 = .7391D-3
            XL3 = -.1040D0
            XL4 = .7063D+1
            XL5 = .1649D3
            GO TO 2
       24   XL1 = .1835D-5
            XL2 = -.2271D-3
            XL3 = -.5727D-2
```

```
      XL4 = .2965D1
      XL5 = .2008D3
      GO TO 2

C     ***** M = 4   BOOSTER *****

    4 P1 = 5.0D1
      P2 = 1.40D2
      P6 = 2.3D2
      P5 = 3.1D2
      IF(HB.GT.P5) GO TO 90
      IF(HB.GE.P4)GO TO 40
      IF(HB.GE.P2)GO TO 41
      IF(HB.GE.P1)GO TO 42
      GO TO 90
   40 XL1 = .3123D-7
      XL2 = -.6148D-5
      XL3 = -.7003D-2
      XL4 = .2501D2
      XL5 = -.1995D3
      GO TO 2
   41 XL1 = .5097D-6
      XL2 = -.2590D-3
      XL3 = .3502D-1
      XL4 = .6331D-1
      XL5 = -.1343D3
      GO TO 2
   42 XL1 = -.8529D-6
      XL2 = .4197D-3
      XL3 = -.7661D-1
      XL4 = .6386D1
      XL5 = -.1654D3
      GO TO 2
   90 ZK = 0.0D0
      B1 = 0.0D0
      GO TO 100
    2 Z1 = XL1*HB4
      Z2 = XL2*HB3
      Z3 = XL3*HB2
      Z4 = XL4*HB
      Z5 = XL5
      B1 = Z1+Z2+Z3+Z4+Z5
      ZK = GM/(2.0D0*X(1)*X(1)*B1)
    5 CONTINUE
  100 RETURN
      END
```

```
      CCONVER     CONVERT TO RADAR COORDINATES
            SUBROUTINE CONVER
            INPUT/OUTPUT MOD 1
      C     THIS ROUTINE DETERMINES WHETHER THE SENSOR UNDER CONSIDERATION IS
      C     CAPABLE OF OBSERVING THE VEHICLE AT ANY TIME AND OF COMPUTING THE
      C     RANGE,RANGE-RATE,RANGE-ACCELERATION,AZIMUTH,AZIMUTH-RATE,AZIMUTH
      C     ACCELERATION,CO-ELEVATION,CO-ELEVATION RATE,CO-ELEVATION
      C     ACCELERATION OF THE VEHICLE RELATIVE TO ANY VISIBLE SENSOR, IF THE
      C     SENSOR OBSERVES THE VEHICLE,ALL DATA IS
      C     PRINTED IN THE TOPOCENTRIC COORDINATE SYSTEM.

            DOUBLE PRECISION COST,COSL,SINT,SINL,EX,Y,Z,EXD,YD,ZD,XDP,YDP,ZDP
           *,REQ ,W2,W3,W4,W5,XS,YS,ZS,SRS,RS,RSD,XNUM1,XNUM2,XNUM3,
           *TWOPI,EF,AK,AHREQ
           *,X1,X3
           *,RS1,RSD1
            DOUBLE PRECISION XNUM,XMUM,S1K,W9,S2K,S3K,S1K2,S2K2,OPS,E,W6,W7
            DOUBLE PRECISION XNLM,ED,SIG,W14,W15,SIGD,RSDD,SIGDD,EDD
            DOUBLE PRECISION SC1,SC2,T,H,XYZ,RSL,PZ,H,W,P,Q
            DOUBLE PRECISION X,XB,XDD
            DOUBLE PRECISION EL,ELD,ELDD,REGAM,HDBETA
            DOUBLE PRECISION TN,STN,TM
            DOUBLE PRECISION PI,HALFPI,TWOPI,ARSIN,COSLT,GNUM,GDEM,BETA,GAM
            DOUBLE PRECISION AM,XPUM,VPRIME,GNUM2,COSB,BNUM
            DOUBLE PRECISION HX,VO,THE,GLAM,THES,GLAMS
            COMMON/TS/T,W,XYZ,RSL,PZ
            COMMON/BS/X(3),XD(3),XDD(3)
            COMMON/AX/TM,M
            COMMON/MS/ GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AM,THES,GLAMS
           */ELIM/ELIM
           */CONCOM/RS,RSD,RSDD,SIG,SIGD,SIGDD,EL,ELD,ELDD,REGAM,HDBETA
           */OUTCOM/X1,X3
           */TIME8/TIME8
           */OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC
           *,IOUT3
            COMMON/W23459/W2,W3,W4,W5,W9
            COMMON/E/E
            LOGICAL IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE
           *,IOUT3
            DATA EF/57.295779513082320 8/,REQ/20925646.0D0/,
           *AK/0.017453292519943295 7/,PI/3.14159265358979323/,
           *HALFPI/1.570796326794896 62/,TWOPI/6.28318530717958648/
            COST=DCOS(X(2))
            COSL=DCOS(X(3))
            SINT=DSIN(X(2))
            SINL=DSIN(X(3))
            EX   =X(1)*COST*COSL
            Y    =-X(1)*COST*SINL
            Z    =X(1)*SINT
            EXD  =XD(1)*COST*COSL-X(1)*XD(2)*SINT*COSL-X(1)*XD(3)*COST*SINL
            YD   =-XD(1)*COST*SINL+X(1)*XD(2)*SINT*SINL-X(1)*XD(3)*COST*COSL
```

```
2-76   15.838          CONVERT TO RADAR COORDINATES                          LA

  53              ZD    =XD(1)*SINT*X(1)*XD(2)*COST
  54              XDP=(XDD(1)-X(1)*(XD(2)*XD(2))-X(1)*(XD(3)*XD(3)))*COST*COSL
  55             1     +(2.0D0*XD(1)*XD(2)+X(1)*XDD(2))*SINT*COSL
  56             2     +(2.0D0*XD(1)*XD(3)+X(1)*XDD(3)))*COST*SINL
  57             3      +2.0D0*X(1)*XD(2)*XD(3)*SINT*SINL
  58              YDP=-(XDD(1)+X(1)*(XD(2)*XD(2))-X(1)*(XD(3)*XD(3)))*COST*SINL
  59             1     +(2.0D0*XD(1)*XD(2)+X(1)*XDD(2))*SINT*SINL
  60             2     -(X(1)*XDD(3)+2.0D0*XD(1)*XD(3)))*COST*COSL
  61             3      +2.0D0*X(1)*XD(2)*XD(3)*SINT*COSL
  62              ZDP=(XDD(1)-X(1)*XD(2)*XD(2))*SINT
  63             1     +(2.0D0*XD(1)*XD(2)+X(1)*XDD(2))*COST
  64              AHREQ = AH + REQ
  65              XS = AHREQ*W3*W5
  66              YS = AHREQ*W3*W4
  67              ZS = AHREQ*W2
  68              SRS=DSQRT(XS**2+YS**2+ZS**2)
  69              S1K=-((EX-XS)*W2*W5+(Y-YS)*W2*W4+(Z-ZS)*W3)
  70              S2K=X(1)*COST*DSIN(X(3)*W5)
  71              S3K=(EX-XS)*W3*W5+(Y-YS)*W3*W4+(Z-ZS)*W2
  72              S1K2=S1K**2
  73              S2K2=S2K**2
  74              S3K2=S3K**2
  75              RS1=DSQRT(S1K2+S2K2+S3K2)
  76              RSD1=(EXD*(EX-XS)+YD*(Y-YS)+ZD*(Z-ZS))/RS1
  77              XNUM1=((EX-XS)*XS)/RS1
  78              XNUM2=((Y-YS)*YS)/RS1
  79              XNUM3=((Z-ZS)*ZS)/RS1
  80              XNUM=(XNUM1+XNUM2+XNUM3)/SRS
  81              XMUM=(XNUM1*XNUM2*XNUM3)*RS1
  82              OPS=DSQRT(S1K2+S2K2)
  83         C  ELEVATION ANGLE CONSTRAINT ON M61 TRAJECTORY SIMULATION
  84              E=DATAN2(OPS,S3K)
  85              IF(E.GT.ELIM)GO TO 200
  86           47 EL = HALFPI - E
  87              RS = RS1
  88              RSD = RSD1
  89              TIME = T
  90              X1 = X(1)
  91              X3 = X(3)
  92           45 W6=DSIN(E)
  93              W7=DCOS(E)
  94              XNUM=XS*EXD+YS*YD+ZS*ZD
  95              ED = (-RS*XNUM+XMUM*RSD)/(SRS*(RS**2)*W6)
  96              ELD=-ED
  97           65 SIG=DATAN2(S2K,S1K)
  98              IF(SIG.GE.0.0D0) GO TO 90
  99              SIG=SIG+TWOPI
 100           90 W14=DSIN(SIG)
 101              W15=DCOS(SIG)
 102              IF(DABS(W14).GE.1.0D-16.AND.W6.GT.0.0D0)GO TO 105
 103          100 SIGD=0.0D0
 104              GO TO 110
```

```
22-76   15.858          CONVERT TO RADAR COORDINATES                                    LAS

  105       105  SIGD =(EXD*W2*W5 + YD*W2*W4-ZD*W3 + (RSD*W6+RS*ED*W7)*W15)
  106          1/(RS*W6*W14)
  107       110  XPUM1=(XS/SRS)*(XDP/RS)
  108            XPUM2=(YS/SRS)*(YDP/RS)
  109            XPUM3=(ZS/SRS)*(ZDR/RS)
  110            XPUM = (XPUM1+XPUM2+XPUM3)/W6
  111            RSDD=(((EX-XS)*XDP+(Y-YS)*YDP+(Z-ZS)*ZDP)
  112           1      +(EXD*EXD+YD*YD+ZD*ZD-RSD*RSD))/RS
  113            EDD = -XPUM + (XNUM/W6)*(RSDD/RS) + (ED*ED*W7)/W6 - 2.0D0*ED*RSD
  114           */RS
  115            ELDD=-EDD
  116            IF(DABS(W14).GE.1.0D-16.AND.W6.GT.0.0D0)GO TO 108
  117            SIGDD=0.0D0
  118            GO TO 109
  119       108  SIGDD=(XDP*W2*W5+YDP*W2*W4-ZDP*W3-2.0D0*RSD*W6*W14*SIGD
  120           1      -2.0D0*RS*W7*W14*ED*SIGD-2.0D0*RS*W8*W15*SIGD*SIGD
  121           2      +2.0D0*RSD*W7*W15*ED+RSDD*W6*W15+RS*EDD*W7*W15)/(RS*W6*W14)
  122        109 CONTINUE
  123            IF(.NOT.IOUT2)RETURN
  124
  125       C  CALCULATION OF HEADING  ANGLE(CLOCKWISE 0 TO 2PI)
  126
  127            COSLT = XD(3)*COST/XD(2)
  128            BNUM = XD(3)*COST
  129            IF (XD(2)) 1,2,3
  130       C  ZERO XD(2)
  131         2  IF(BNUM) 4,5,6
  132       C  NEGATIVE BNUM
  133         4  BETA = THALF
  134            GO TO 60
  135       C  ZERO BNUM
  136         5  BETA = 1.0D1*PI
  137            GO TO 60
  138       C  POSITIVE BNUM
  139         6  BETA = HALFPI
  140            GO TO 60
  141       C  NEGATIVE XD(2)
  142         1  IF(BNUM) 7,8,9
  143       C  NEGATIVE OR POSITIVE BNUM
  144         7  BETA = PI + DATAN(COSLT)
  145            GO TO 60
  146         9  BETA = PI + DATAN(COSLT)
  147            GO TO 60
  148       C  ZERO BNUM
  149         8  BETA = PI
  150            GO TO 60
  151       C  POSITIVE XD(2)
  152         3  IF(BNUM) 10,11,12
  153       C  NEGATIVE BNUM
  154         10 BETA = TWOPI + DATAN(COSLT)
  155            GO TO 60
  156       C  ZERO BNUM
```

```
2-76   15.858          CONVERT TO RADAR COORDINATES                    LA

  157          11  BETA = 0.0D0
  158              GO TO 60
  159        C   POSITIVE GNUM
  160          12  BETA = DATAN(COSLT)
  161        C  CALCULATION OF RE/ENTRY ANGLE(CLOCKWISE 0 TO 2PI)
  162          60  COSB = DCOS(BETA)
  163              GNUM = X(1)*XD(2) / COSB
  164              GDEM = XD(1)
  165              IF(GDEM) 13,14,15
  166        C  ZERO GDEM
  167          14  IF (GNUM) 16,17,18
  168        C   NEGATIVE GNUM
  169          16  ARSIN = TIWARI
  170              GO TO 62
  171        C  ZERO GNUM
  172          17  ARSIN = 1.0D1*PI
  173              GO TO 62
  174        C   POSITIVE GNUM
  175          18  ARSIN = HALFPI
  176              GO TO 62
  177        C       NEGATIVE GDEM
  178          13  IF(GNUM) 19,20,24
  179        C       NEGATIVE OR POSITIVE GNUM
  180          19  ARSIN = TWOPI + DATAN2(GNUM,GDEM)
  181              GO TO 62
  182          24  ARSIN = DATAN2(GNUM,GDEM)
  183              GO TO 62
  184        C       ZERO GNUM
  185           20 ARSIN = PI
  186              GO TO 62
  187        C       POSITIVE GDEM
  188           15 IF (GNUM) 21,22,23
  189        C       NEGATIVE GNUM
  190           21 ARSIN = TWOPI + DATAN2 (GNUM,GDEM)
  191              GO TO 62
  192        C       ZERO GNUM
  193           22 ARSIN = 0.0D0
  194              GO TO 62
  195        C       POSITIVE GNUM
  196           23 ARSIN = DATAN2 ( GNUM,GDEM)
  197              GO TO 62
  198          62  GAM = ARSIN
  199              REGAM = GAM
  200              RDBETA = BETA
  201        200   RETURN
  202                END
MEMORY EXPANDED. USE $LIMITS OR CORE= OPTION FOR NEXT RUN
```

```
      CEQTNX      COMPUTE ACCELERATION COMPONENTS
            SUBROUTINE EQTNX
      C  THIS ROUTINE COMPUTES THE VEHICLE'S ACCELERATION COMPONENTS
      C  REQUIRING VARIABLE BALLISTIC COEFFICIENTS AND DENSITY FROM
      C  ROUTINES BALCOF AND ATMOSPHE, RESPECTIVELY

            DOUBLE PRECISION H,RSL,PZ,T
            DOUBLE PRECISION V6,EL2,EL3,EL4,EL5,EL6,AA
            DOUBLE PRECISION DV,XYZ,ZK,S1,S2,S3,S4,S6,VA,VDD,VD,S23,Q1,Q2,Q3
            DOUBLE PRECISION X,XD,XDD
            DOUBLE PRECISION A,R,W,TM,B1
            DOUBLE PRECISION P1
            LOGICAL IOUT1,IOUT2,IOUT3,KZ,KAT,SPHERE,IPLOT1,IPLOT2
            DIMENSION DV(5)
            COMMON/BS/X(3),XD(3),XDD(3)
            COMMON/TS/T,H,XYZ,RSL,PZ
            COMMON/A/R,W
            COMMON/GE/ZK,B1,P1
           */OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC,IOUT3
            DATA DV/2.4216704D12,4.0,0D0/
           */,S6/2.0D0/
            S1=DCOS(X(2))
            S2=DSIN(X(2))
            S3=DSIN(S6*X(2))
            S4=DCOS(S6*X(2))
            RSL = R
            H=  X(1)- RSL

            IF(.NOT.KAT)GO TO 31
            CALL BALCOF
            CALL ATMOSP

         31 VA = (XD(1)*XD(1))/(X(1)*X(1))+XD(2)*XD(2)*(S1*(XD(3)+W))**2
      C  VEHICLE'S INERTIAL SPEED (COMPUTED OUTPUT)
            XYZ=X(1)*DSQRT(VA)
            VDD= XD(1)*XD(1)+ X(1)*XD(2)*X(1)*XD(2)+(X(1)*(XD(3)-W)*S1)**2
      C  VEHICLE SPEED WRT THE ATMOSPHERIC WIND
            VD=DSQRT(VDD)
            S23=-PZ*ZK*VD
      C  DRAG FORCES CONJUGATE TO GEO.RADIUS,LATITUDE,LONGITUDE(FT/MIN/MIN)
            Q1= S23*XD(1)
            Q2= S23*XD(2)
            Q3=  S23*(XD(3)-W)
            V6 = R/X(1)
            EL2=X(1)*XD(2)*XD(2)+0.5D0*(1.0D0+S4)*(W+XD(3))*(W+XD(3))*X(1)
            EL3=DV(1)/X(1)*V6+DV(2)/X(1)*V6**3*(3.0D0*S4-1.0D0)
            EL4=DV(3)/X(1)*V6**5*(35.0D0*S4*S4-10.0D0*S4-13.0D0)
      C  GEOCENTRIC RADIAL ACCELERATION (FT/MIN/MIN)
            XDD(1)= EL2-EL3-EL4+Q1
            EL5=(-S6*XD(2)*XD(1))/X(1))-0.5D0*S3*(W+XD(3))*(W+XD(3))
            EL6=-DV(4)/(X(1)*X(1))*V6**3*S3+DV(5)/(X(1)*X(1))*V6**5*S3*(1.0D0-
           17.0D0*S4)
```

```
2-76   15.889          COMPUTE ACCELERATION COMPONENTS                    LA

  53       C  GEOCENTRIC LATITUDE ANGULAR ACCELERATION (RAD/MIN/MIN)
  54              YDD(2)=EL5*EL6*Q2
  55              AA=-1.0D0*(W*XD(3))
  56       C  GEOCENTRIC LONGITUDE ANGULAR ACCELERATION(RAD/MIN/MIN)
  57              XDD(3)=AA*   (S6*XD(1)/X(1))+AA*(S5*XD(2)*S2)/S1*03
  58              RETURN
  59              END
```

```
      CICERBM     GEOCENTRIC SPHERICAL COMPONENTS
            SUBROUTINE ICERBM

      C     INPUT/OUTPUT MOD 2,MULTIPLE SITE/TRAJECTORY VERSION

      C     THIS ROUTINE ACCEPTS BOUNDARY CONDITIONS OF VEHICLE AND COMPUTES
      C     GEOCENTRIC SPHERICAL COMPONENTS OF POSITION AND VELOCITY VECTORS.
      C     IN ADDITION, PERTURBATION TECHNIQUE IS INCORPORATED TO COMPUTE
      C     THE RESULTANT EFFECT OF SINGULAR OR MULTIPLE PERTURBATIONS OF
      C     NOMINAL COMPONENTS OR VELOCITY.

            DOUBLE PRECISION VO,RAT,XX,ZK,B1,P1
            DOUBLE PRECISION RDP,RTDP,RLDP,C13,GMU,CA,GAM,BETA,GLAM,HX,THE,RO
            DOUBLE PRECISION X,XD,XDD
            DOUBLE PRECISION SC1,SC2,T,H,XYZ,RSL,PZ,R,W
            DOUBLE PRECISION XN, XDN,XN1(20),XDN1(20)
            DOUBLE PRECISION COSGAM,COSBET,SINGAM,SINBET,V2,A,B,C
            DOUBLE PRECISION  SN1,V80DR,V80
            DOUBLE PRECISION RATN
            DOUBLE PRECISION TN,STN,TM
            DOUBLE PRECISION THES,GLAMS,AH
            COMMON/BS/X(3),XD(3),XDD(3)
             COMMON/TS/T,H,XYZ,RSL,PZ
            COMMON/A/R,W/M2/TRAJ/XX(11)
            COMMON/AX/TM,MT/QE/ZK,B1,P1
            COMMON/MS/ GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AH,THES,GLAMS
           */ABC/A(20),B(20),C(20)
           */OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC,IOUT3
           */OPT1/INERTL
            DIMENSION RDP(20),RTDP(20),RLDP(20),XN(3),XDN(3)
            LOGICAL IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,IOUT3,INERTL
            DATA C13/0.017453292519943295/,GMU/3.0675004D19/
            IF(MT-2)6,10,16
        6   CONTINUE
            RO = R + HX
            XD(1)=VO*DCOS(GAM*C13)
            IF(GAM.EQ.90.0D0)XD(2)=0.0D0
            XD(2)=VO/RO*DSIN(GAM*C13)*DCOS(BETA*C13)
            RAT=RO*DCOS(THE*C13)
            XD(3)=VO*DSIN(GAM*C13)*DSIN(BETA*C13)/RAT
            IF(INERTL)XD(3)=XD(3)+W
            X(1)=RO
            X(2)= THE*C13
            X(3)= GLAM*C13
            IF(.NOT.KZ)GO TO 30
            DO 15 I=1,3
            XN1(I) = X(I)
       15   XDN1(I) = XD(I)
       30   RETURN

      C  INITIAL BOUNDARY CONDITIONS TO SIMULATE TIMEWISE BACKWARD TRAJECTORY
```

```
2-76   15.896          GEOCENTRIC SPHERICAL COMPONENTS                    LAI

   53          10 RO = 1.38333730108
   54             X(1) = XX(1)
   55             X(2) = THES*C13
   56             X(3) = GLAMS*C13
   57             XD(1) = XX(4)
   58             XD(2) = XX(5)
   59             XD(3) = XX(6)
   60             XDD(1) = XX(7)
   61             XDD(2) = XX(8)
   62             XDD(3) = XX(9)
   63             ZK = XX(10)
   64             PZ = XX(11)
   65               RETURN
   66          16 IF(MT.GT.3)GO TO 35
   67             DO 18 I = 1,3
   68             XN(I) = X(I)
   69             XDN(I) = XD(I)
   70          18 CONTINUE
   71             RETURN
   72          35 IF(.NOT.KZ)GO TO 20
   73             DO 40 I=1,3
   74             X(I) = XN1(I)
   75             XD(I) = XDN1(I)
   76             XN(I) = XN1(I)
   77          40 XDN(I) = XDN1(I)
   78             GO TO 45
   79          20 DO 25 I = 1,3
   80             X(I) = XN(I)
   81          25 CONTINUE
   82          45 SN1 = DCOS(XN(2)*C13)
   83             VBODR = DSQRT((XDN(1)/XN(1))**2 + XDN(2)*XDN(2)*(SN1*XDN(3))**2)
   84             VBO = XN(1) * VBODR
   85             BETA = DATAN2(XDN(3),SN1 ,XDN(2))
   86             COSBET = DCOS(BETA)
   87             SINBET = DSIN(BETA)
   88             COSGAM = XDN(1) / VBO
   89             SINGAM = XDN(2) /(VBODR * COSBET)
   90             M = MT-3
   91             V2 = B(M)*SINGAM*C(M)*COSGAM
   92             RDP(M) = (-B(M)*COSGAM*C(M)*SINGAM)*60.0D0
   93             RTDP(M) = (-V2*COSBET+A(M)*SINBET)*60.0D0
   94             RLDP(M) = (-V2*SINBET+A(M)*COSBET)*60.0D0
   95             XD(1) = XDN(1) + RDP(M)
   96             XD(2) = XDN(2) + RTDP(M)/XN(1)
   97             RATN = XN(1)* DCOS(XN(2)*C13)
   98             XD(3) = XDN(3) + RLDP(M)/RATN
   99             RETURN
  100             END
QUALITY OR NON-EQUALITY COMPARISON MAY NOT BE MEANINGFUL IN LOGICAL IF EXPRESSIONS
```

```
CINIT       INITIALIZATION SUBROUTINE                                          00000010
      SUBROUTINE INITAL                                                        00000020
                                                                               00000030
C     INPUT/OUTPUT MOD 2,MULTIPLE SITE/TRAJECTORY VERSION                      00000040
                                                                               00000050
C     THIS SUBROUTINE PERFORMS SOME OF THE INITIALIZATION NEEDED FOR THE       00000060
C     PROGRAM, ESPECIALLY FOR PRODUCING OUTPUT.                                00000070
                                                                               00000080
      COMMON/INOUT/INCOUT,IOUT,NOFF1,NOFF2,NOFF3,IOUTA                        00000090
     *,TO/TO/TS/T,H,XYZ,RSL,PZ                                                 00000100
     *,OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC,IOUT3             00000110
     *,RTD/RTD,RTD60,RTD36,F36,F6080,FERU                                      00000120
      COMMON/W23459/W2,W3,W4,W5,W9                                             00000130
     *,MS/GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AH,THES,GLAMS                        00000140
      COMMON/GE/ZK,B1,P1/A/H,W/ST/P(3),Q(3)                                    00000150
     *,GEOXK/GEO,XK/AX,TM,M                                                    00000160
     *,SWSW/SWTCH1,SWTCH2/SW10/SWCH10                                          00000170
     *,SW3SW4/SWTCH3,SWTCH4                                                    00000180
     *,SW5SW6/SWTCH5,SWTCH6                                                    00000190
     *,SW7/SWTCH7/SW8/SWTCH8/SW9/SWTCH9                                        00000200
     *,NR/NREC1,NREC2,NREC3,NREC4,NREC5,NREC                                   00000210
     *,NR6/NREC6/IT2,IT2,IT                                                    00000220
     *,TIME5/TIME5/TIMEL/TIMEL,TIMES                                           00000230
      COMMON/NR7/NREC7,NOFF4                                                   00000240
     *,SITES/NSITE,SLAT(20),SLONG(2 ),SALT(20)                                 00000250
     *,ISITE/ISITE                                                             00000260
      LOGICAL IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,IOUT3                   00000270
      LOGICAL SWTCH1,SWTCH2,SWCH10                                             00000280
      LOGICAL SWTCH3,SWTCH4                                                    00000290
      LOGICAL SWTCH5,SWTCH6                                                    00000300
      LOGICAL SWTCH7,SWTCH8,SWTCH9                                             00000310
      DOUBLE PRECISION ZK,B1,P1,R,W,GEO,XK,P,Q                                 00000320
      DOUBLE PRECISION W2,W3,W4,W5,W9,GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,         00000330
     *AH,THES,GLAMS,AK,W10,TO,T,H,XYZ,RSL,PZ,TM                                00000340
     *,SLAT,SLONG,SALT,TIMEL,TIMES                                             00000350
      DATA AK/0.0174532925199432957/                                           00000360
      RTD = 57.295780                                                          00000370
      RTD60 = RTD/6 .                                                          00000380
      RTD36 = RTD/360.                                                         00000390
      F36= 1.0/36 .0                                                           00000400
      F6080 = 1.0/6080.0                                                       00000410
      FERU = 1. /20925640.                                                     00000420
      T = 0.0D0                                                                00000430
      PZ = 0.0D0                                                               00000440
      ZK = 0.0D0                                                               00000450
      DO 11 I=1,3                                                              00000460
      P(I)=0.0D0                                                               00000470
   11 Q(I)=0.0D0                                                               00000480
      IF(M.NE.2)GO TO 2                                                        00000490
      T = TIMEL                                                                00000500
      SWCH10 = .FALSE.                                                         00000510
      IF(T.LT.TIMES+TO)GO TO 2                                                 00000520
```

```
      LWCH10 = .TRUE.                                                    00000530
      LT2 = (T-TIMES41.0D-5)/TO                                          00000540
   20 LNCOUT = (OUTINC + 1.0E-09)/TO                                     00000550
      LOUT = 0                                                           00000560
      LOUTA = 0                                                          00000570
      NOFF1 = 676                                                        00000580
      IF(IOUT1)NOFF1=364                                                 00000590
      NOFF2 = 624                                                        00000600
      NOFF3 = NOFF2                                                      00000610
      IF(IOUT2)NOFF2=384                                                 00000620
      IF(IPLOT2)NOFF3=364                                                00000630
      NOFF4= 554                                                         00000640
      IF(ISITE.EQ.0)GO TO 10                                             00000650
      SC1 = SLAT(ISITE)                                                  00000660
      SC2 = SLONG(ISITE)                                                 00000670
      AH = SALT(ISITE)                                                   00000680
      W9=SC2*AK                                                          00000690
      W10 = SC1*AK                                                       00000700
      W2 = DSIN(W10)                                                     00000710
      W3 = DCOS(W10)                                                     00000720
      W4 = DSIN(W9)                                                      00000730
      W5 = DCOS(W9)                                                      00000740
   10 TIME5 = 0.0                                                        00000750
      NREC1 = 0                                                          00000760
      NREC2 = 0                                                          00000770
      NREC3 = 0                                                          00000780
      NREC4 = 0                                                          00000790
      NREC5 = 0                                                          00000800
      NREC6 = 0                                                          00000810
      NREC7=0                                                            00000820
                                                                         00000830
C  PHYSICAL CONSTANTS OF THE EARTH MODEL,EQUATORIAL RADIUS AND ANGULAR    00000840
C     SPEED                                                            00000850
                                                                         00000860
      M = 20925640.00                                                    00000870
      W=0.4375269048D-2                                                  00000880
      RK=5.72961D1                                                       00000890
                                                                         00000900
C  UPPER VALUE OF THE TARGET'S GEOCENTRIC RADIAL DISTANCE(FT)             00000910
                                                                         00000920
      GEO = 1.3833378018D8                                               00000930
      P1 = 0.0D0                                                         00000940
      LWTCH1 = .TRUE.                                                    00000950
      LWTCH2 = .TRUE.                                                    00000960
      LWTCH3 = .FALSE.                                                   00000970
      LWTCH4 = .TRUE.                                                    00000980
      LWTCH6 = .TRUE.                                                    00000990
      LWTCH7 = .TRUE.                                                    00001000
      LWTCH8=.TRUE.                                                      00001010
      LWTCH9 = .TRUE.                                                    00001020
      RETURN                                                             00001030
      END                                                                00001040
```

```
CINPUT      INPUT SUBROUTINE                                                  00001050
                                                                              00001060
      SUBROUTINE INPUT                                                        00001070
                                                                              00001080
C     THIS ROUTINE PERFORMS THE INPUT FUNCTION THRU CARDS FOR THE             00001090
C     PROGRAM.                                                                00001100
                                                                              00001110
      COMMON/AX/TM,M/NTRAJ/ITM                                                00001120
     *,MS/GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AH,THES,GLAMS                       00001130
     *,ELIM/ELIM/NSWTCH/NSWTCH                                                00001140
     *,OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC,IOUT3            00001150
     *,OPT1/INERTL                                                            00001160
     *,ABC/A(20),B(20),C(20)                                                  00001170
      COMMON/SITES/NSITE,SLAT(20),SLONG(20),SALT(20)                          00001180
      DOUBLE PRECISION GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AH,THES,GLAMS,TM,      00001190
     *ELIM,A,B,C,SLAT,SLONG,SALT                                              00001200
      LOGICAL IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,IOUT3,IEOFP,INERTL      00001210
      DATA DTR/0.017453293/                                                   00001220
      NAMELIST/INPUT1/NTRAJ,TM,NSWTCH                                         00001230
     *,INPUT2/IOUT1,IPLOT1,IPLOT2,IOUT2,KAT,KZ,SPHERE,OUTINC,IOUT3           00001240
     *,INERTL                                                                 00001250
     *,INPUT3/GAM,BETA,HX,VO,THE,GLAM,THES,GLAMS                              00001260
     *,INPUT4/NSITE,SLAT,SLONG,SALT,ELIM                                      00001270
     *,INPUT5/A,B,C                                                           00001280
      CALL FLGEOF (5,IEOFP)                                                   00001290
                                                                              00001300
C     INPUT TRAJECTORY NUMBER,TIME LIMIT,MAIN PROCESSING SWITCH               00001310
                                                                              00001320
      READ(5,INPUT1)                                                          00001330
      IF(IEOFP)STOP                                                           00001340
                                                                              00001350
      ITM = NTRAJ                                                             00001360
      WRITE(6,10)NTRAJ,TM,NSWTCH                                              00001370
   10 FORMAT(1H1//5X,"MISSILE TRAJECTORY PROGRAM(MULTIPLE SITE/TRAJECTOR      00001380
     *Y MOD) INPUTS"//,14X,"PROGRAM CONTROLS"///10X,"NUMBER OF TRAJECTOR      00001390
     *IES SIMULATED(NTRAJ)",I6/,10X,"MAXIMUM TIME FOR A TRAJECTORY(TM)",      00001400
     *F15.5," MIN."//,10X,"MAIN PROCESSING SWITCH(NSWTCH)",I6)                00001410
                                                                              00001420
C     INPUT OTHER PROGRAM CONTROLS                                            00001430
                                                                              00001440
      READ(5,INPUT2)                                                          00001450
                                                                              00001460
      WRITE(6,60)IOUT1,IOUT2,OUTINC,IOUT3,KZ,IPLOT1,IPLOT2,KAT,SPHERE        00001470
   60 FORMAT(///10X,25HPRINT-OUT OPTION 1(IOUT1),L6,10X,25HPRINT-OUT OPTI     00001480
     *ON 2(IOUT2),L6//1 X,51HINCREMENT BETWEEN TIME POINTS FOR PRINT-OUT      00001490
     *(OUTINC),F10.3,5H MIN.,//1 X,54HPRINTOUT OPTION FOR RADAR PARAMETER     00001500
     * DIFFERENCES(IOUT3),L6,1 X,39HNOMINAL TRAJECTORY SELECTION SWITCH(      00001510
     *KZ),L6///10X,25HPLOTTING OPTION 1(IPLOT1),L6,10X,25HPLOTTING OPTIO      00001520
     *N 2(IPLOT2),L6//1 X,29HATMOSPHERIC MODEL OPTION(KAT),L6//10X,29HSP      00001530
     *HERICAL EARTH MODEL(SPHERE),L6)                                         00001540
      WRITE(6,65)INERTL                                                       00001550
   65 FORMAT(//10X,32HINERTIAL VELOCITY OPTION(INERTL),L6)                    00001560
```

```
C     INPUT INITIAL STATE VECTOR OF THE INTERCEPTOR                     0000157
C     INPUT SUBSATELLITE PARAMETERS                                     0000158
                                                                        0000159
      READ(5,INPUT3)                                                    0000160
                                                                        0000161
      WRITE(6,24)                                                       0000162
   24 FORMAT(//10X,60H************************************************0000163
     ***********//)                                                    0000164
      WRITE(6,20)GAM,BETA,HX,VO,THE,GLAM                                0000165
   20 FORMAT(///14X,39HINITIAL STATE VECTOR OF THE INTERCEPTOR///10X,36H0000166
     *RE-ENTRY ANGLE WRT THE VERTICAL(GAM),D15.5,5H DEG.//10X,38HHEADING0000167
     * ANGLE WRT RELATIVE NORTH(BETA),D15.5,5H DEG.//10X,32HHEIGHT OF MI0000168
     *SSILE AT BURNOUT(HX),D15.5,4H FT.//10X,52HVELOCITY OF MISSILE RELA0000169
     *TIVE TO BURNOUT AT EPOCH(VO),D17.10,9H FT./SEC.//10X,65HGEOCENTRIC0000170
     * LATITUDE AT BURNOUT, +NORTH AND -SOUTH OF EQUATOR(THE),D15.5,5H D0000171
     *EG.//10X,44HGEOCENTRIC LONGITUDE.EAST OF GREENWICH(GLAM).D15.5,5H 0000172
     *DEG.)                                                             0000173
      VO = VO*60.0                                                      0000174
      WRITE(6,40)THES,GLAMS                                             0000175
   40 FORMAT(///14X,23HSUBSATELLITE PARAMETERS///10X,55HGEOCENTRIC LATIT0000176
     *UDE, +NORTH AND -SOUTH OF EQUATOR(THES),D15.5,5H DEG.//10X,45HGEOC0000177
     *ENTRIC LONGITUDE.EAST OF GREENWICH(GLAMS),D15.5,5H DEG.)          0000178
      IF(NSWTCH.EQ.1)GO TO 90                                           0000179
                                                                        0000180
                                                                        0000181
C     INPUT RADAR PARAMETERS                                            0000182
                                                                        0000183
      READ(5,INPUT4)                                                    0000184
                                                                        0000185
      WRITE(6,24)                                                       0000186
      WRITE(6,30)(I,SLAT(I),SLONG(I),SALT(I),I=1,NSITE)                 0000187
   30 FORMAT(///14X,"RADAR PARAMETERS"//10X,"SITE NUMBER",I6//10X,"GEOCE0000188
     *NTRIC LATITUDE OF RADAR, +NORTH AND -SOUTH OF EQUATOR(SLAT)",D15.50000189
     *," DEG."//10X,"GEOCENTRIC LONGITUDE OF RADAR,WEST OF GREENWICH(SLO0000190
     *NG)",D15.5," DEG."//10X,"ALTITUDE OF RADAR ABOVE SEA LEVEL(SALT)",0000191
     *D15.5," FT.")                                                     0000192
      WRITE(6,50)ELIM                                                   0000193
   50 FORMAT(///10X,"MAXIMUM CO-LATITUDE OF ELEVATION ANGLE FOR WHICH C0000194
     *VERAGE PARAMETERS ARE DETERMINED(ELIM)",D15.5," DEG.")            0000195
      ELIM = ELIM*DTR                                                   0000196
   90 IF(NTRAJ.LE.3)RETURN                                              0000197
                                                                        0000198
C     INPUT VELOCITY PERTURBATIONS                                      0000199
                                                                        0000200
      READ(5,INPUT5)                                                    0000201
                                                                        0000202
      WRITE(6,24)                                                       0000203
      NT=NTRAJ-3                                                        0000204
      WRITE(6,70)(A(I),I=1,NT)                                          0000205
   70 FORMAT(///14X,22HVELOCITY PERTURBATIONS///10X,95HOUT OF TRAJECTORY0000206
     * PLANE PERTURBATION, +EJECTED TO THE LEFT OF NOMINAL TRAJECTORY(A)0000207
     * IN FT./SEC.//(5X,5D17.5))                                        0000208
```

```
      WRITE(6,8 )(B(I),I=1,NT)                                          0002090
   80 FORMAT(//1 X,8UHIN PLANE PERTURBATION, +EJECTED BACKWARDS FROM NOM0002100
     *INAL TRAJECTORY(B) IN FT./SEC.//(5X,5D17.5))                      0002110
      WRITE(6,1  )(C(I),I=1,NT)                                         0002120
  100 FORMAT(//1 X,78HIN PLANE PERTURBATION, +EJECTED UPWARDS FROM NOMIN0002130
     *AL TRAJECTORY(C) IN FT./SEC.//(5X,5D17.5))                        0002140
      RETURN                                                            0002150
      END                                                               0002160
```

```
CINTRAJ        INPUT TRAJECTORY DATA FROM FILE                          00000050
C                                                                       00000055
      SUBROUTINE INTRAJ                                                 00000060
C                                                                       00000065
C     THIS ROUTINE READS THE TRAJECTORY DATA PLACED ON A FILE           00000070
C     SO THAT RADAR COVERAGE PARAMETERS MAY BE COMPUTED.                00000080
C     IT WILL ALSO READ AND STORE RADAR DATA NEEDED FOR CALCULATING     00000085
C     RADAR PARAMETER DIFFERENCES.                                      00000086
C                                                                       00000087
      COMMON/NR7/NREC7,NOFF4/AX/TM,NTRJ/ISITE/ISITE                     00000090
     &  /OUTT/OUTTJ(5000)/NSWTCH/NSWTCH                                 00000100
     &  /JX/JX/TIME1/TIMEBS/TB(9)                                       00000110
     &   /SITES/NSITE,SLAT(20),SLONG(20),SALT(20)                       00000115
     &   /TSIGHT/TIMESI(10,10,5),TIMESF(10,10,5),NSIGHT(10,10)          00000116
     &   /NTRAJ/NTRAJ/IJJ/INOM,I,JSITE,JSIGHT,TSTART,TEND               00000117
     &   /OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC,        00000118
     &   IOUT3                                                          00000119
      DOUBLE PRECISION TB,TM,SLAT,SLONG,SALT                            00000120
      LOGICAL IPLOT2,EOF,SWTCH2,EOF10,                                  00000125
     &   IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,IOUT3                  00000126
      IF(NTRJ.GT.2)GO TO 20                                             00000130
      REWIND 9                                                          00000140
   50 READ(9)IREC,TIME1                                                 00000150
      RETURN                                                            00000160
   20 IF(NSWTCH.EQ.2)GO TO 25                                           00000165
      IF(ISITE.NE.1)GO TO 3                                             00000170
   35 BACKSPACE 9                                                       00000171
      READ(9)IREC,NREC7                                                 00000172
      IBACK=IREC                                                        00000173
      IF(NREC7.EQ.0.AND.IREC.EQ.2)RETURN                                00000174
   30 DO 40 IB=1,IBACK                                                  00000180
   40 BACKSPACE 9                                                       00000190
      GO TO 50                                                          00000200
   25 IF(ISITE.EQ.1)GO TO 50                                            00000205
      IF(ISITE.EQ.2)GO TO 35                                            00000210
      GO TO 30                                                          00000215
                                                                        00000230
      ENTRY TRAJIN                                                      00000240
      READ(9)IREC,NREC7                                                 00000250
      IF(NREC7.EQ.0)RETURN                                              00000270
      NDATA = NREC7*9                                                   00000280
      READ(9)IREC,(OUTTJ(I),I=1,NDATA)                                  00000290
      RETURN                                                            00000310
C                                                                       00000320
      ENTRY TRAJX                                                       00000330
C                                                                       00000340
C     STORE TRAJECTORY DATA FROM INPUT BUFFER IN TRAJECTORY             00000350
C     ARRAYS                                                            00000360
C                                                                       00000370
      II=1                                                              00000380
      DO 10 JJ=JX,JX+8                                                  00000390
      TR(II)=OUTTJ(JJ)                                                  00000400
```

```
      II=II+1                                                          00000410
   10 CONTINUE                                                         00000420
      JX=JX+9                                                          00000430
      RETURN                                                           00000440
C                                                                      00000450
      ENTRY TIMEST                                                     00000460
C                                                                      00000470
C     READ IN AND STORE TIMES OF SIGHTING FOR COMPUTATION OF           00000480
C     RADAR PARAMETER DIFFERENCES.                                     00000490
C                                                                      00000500
C                                                                      00000510
C     READ IN AND STORE TIMES OF SIGHTING OF NOMINAL TRAJECTORY        00000520
C     BY ALL RADAR SITES.                                              00000530
C                                                                      00000540
      REWIND 11                                                        00000550
       INOM=1                                                          00000560
      IF(.NOT.KZ)INOM=3                                                00000570
      JJ=1                                                             00000580
      II=0                                                             00000590
  130 READ(11)TIME3,IPLOT2,IO2,EOF                                     00000600
      IF(EOF)GO TO 1 0                                                 00000610
      II=II+1                                                          00000620
      TIMESI(INOM,JJ,II)=TIME3                                         00000630
  120 READ(11)NREC3,ITR,IS,EOF1 ,SWTCH2                                00000640
      IF(EOF10)GO TO 11                                                00000650
      READ(11)DUMMY                                                    00000660
      GO TO 120                                                        00000670
  110 READ(11)TIME7                                                    00000680
      TIMESF(INOM,JJ,II)=TIME7                                         00000690
      GO TO 130                                                        00000700
  100 NSIGHT(INOM,JJ)=II                                               00000710
      IF(JJ.EQ.NSITE)GO TO 140                                         00000720
       JJ=JJ+1                                                         00000730
       II=0                                                            00000740
      GO TO 130                                                        00000750
C                                                                      00000760
C     READ IN AND STORE TIMES OF SIGHTING OF ALL OTHER TRAJECTORIES    00000770
C     BY ALL SITES.                                                    00000775
C                                                                      00000780
  140 REWIND 11                                                        00000790
       REWIND 1                                                        00000795
      IF(.NOT.KZ)GO TO 1                                               00000800
  195 JJ=1                                                             00000805
  190 READ(11)DUM,DUM,DUM,EOF                                          00000810
      IF(EOF)GO TO 160                                                 00000820
  180 READ(11)DUM,DUM,DUM,EOF10,DUM                                    00000830
      IF(EOF10)GO TO 17                                                00000840
      READ(11)DUM                                                      00000850
      GO TO 180                                                        00000860
  170 READ(11)DUM                                                      00000870
      GO TO 190                                                        00000880
  160 IF(JJ.EQ.NSITE)GO TO 200                                         00000890
```

```
      JJ=JJ+1                                                          00000900
      GO TO 190                                                        00000910
  150 ITRAJ=1                                                          00000915
      GO TO 270                                                        00000917
  200 ITRAJ=4                                                          00000920
  270 JJ=1                                                             00000930
      II=0                                                             00000950
  220 READ(10)TIME3,DUM,DUM,EOF                                        00000960
      IF(EOF)GO TO 230                                                 00000970
      II=II+1                                                          00000980
      TIMESI(ITRAJ,JJ,II)=TIME3                                        00000990
  240 READ(10)NREC3,ITR,IS,EOF1,SWTCH2                                 00001000
      IF(EOF10)GO TO 25                                                00001010
      READ(10)DUMMY                                                    00001020
      GO TO 240                                                        00001030
  250 READ(10)TIME7                                                    00001040
      TIMESF(ITRAJ,JJ,II)=TIME7                                        00001050
      GO TO 220                                                        00001060
  230 NSIGHT(ITRAJ,JJ)=II                                              00001070
      IF(JJ.EQ.NSITE)GO TO 260                                         00001080
      JJ=JJ+1                                                          00001090
      II=0                                                             00001100
      GO TO 220                                                        00001110
  260 IF(ITRAJ.EQ.1)GO TO 195                                          00001115
      IF(ITRAJ.EQ.NTRAJ)GO TO 280                                      00001120
      ITRAJ=ITRAJ+1                                                    00001130
      GO TO 270                                                        00001140
  280 REWIND 10                                                        00001150
      RETURN                                                           00001160
C                                                                      00001170
      ENTRY INTER                                                      00001180
C                                                                      00001190
C     DETERMINE THE INTERSECTIONS OF THE TIME SETS                     00001200
C                                                                      00001210
      JSIGHT=1                                                         00001220
      IF(TIMESI(INOM,JSITE,JSIGHT).GE.TIMESI(I,JSITE,JSIGHT))         00001230
     &   GO TO 290                                                     00001240
      IF(TIMESF(INOM,JSITE,JSIGHT).LE.TIMESF(I,JSITE,JSIGHT))         00001250
     &   GO TO 300                                                     00001260
      TSTART=TIMESI(I,JSITE,JSIGHT)                                    00001270
      TEND=TIMESF(I,JSITE,JSIGHT)                                      00001280
  310 RETURN                                                           00001290
  300 TSTART=TIMESI(I,JSITE,JSIGHT)                                    00001300
      TEND =TIMESF(INOM,JSITE,JSIGHT)                                  00001310
      GO TO 310                                                        00001320
  290 IF(TIMESF(INOM,JSITE,JSIGHT).GE.TIMESF(I,JSITE,JSIGHT))         00001330
     &    GO TO 320                                                    00001340
      TSTART=TIMESI(INOM,JSITE,JSIGHT)                                 00001350
      TEND=TIMESF(INOM,JSITE,JSIGHT)                                   00001360
      GO TO 310                                                        00001370
  320 TSTART=TIMESI(INOM,JSITE,JSIGHT)                                 00001380
      TEND =TIMESF(I,JSITE,JSIGHT)                                     00001390
```

```
      GO TO 310                                                    00001400
      END                                                          00001410
```

```
COUTPUT     OUTPUT SUBROUTINE                                                   00000010
      SUBROUTINE OUTPUT                                                        00000020
                                                                               00000030
C       INPUT/OUTPUT MOD 2,MULTIPLE SITE/TRAJECTORY VERSION                    00000040
C                                                                              00000045
C     THIS SUBROUTINE PRODUCES THE PRINT-OUT OF THE RESULTS OF A PROGRAM       00000050
C     RUN. MISSILE/SATELLITE TRAJECTORY PARAMETERS(POSITION,VELOCITY,ETC       00000060
C     .) ARE PRINTED-OUT, AS ARE THE TRAJECTORIES AS SEEN BY VARIOUS           00000070
C     RADAR SITES.                                                             00000080
C      THIS ROUTINE ALSO IS USED FOR TEMPORARY STORAGE OF                      00000085
C     TRAJECTORY AND RADAR DATA AND CAN WRITE A FILE                           00000086
C     FOR LATER USE IN PLOTTING.                                               00000087
      COMMON/TS/T,H,XYZ,RSL,PZ                                                 00000090
     *,CONCOM/RS,RSD,RSDD,SIG,SIGD,SIGDD,EL,ELD,ELDD,REGAM,HDBETA              00000100
     *,OUTCOM/X1,X3/TIME2/TIME2                                                00000110
     *,TIME8/TIME8/ISITE/ISITE                                                 00000120
     *,BS/X(3),XD(3),XDD(3)                                                    00000130
     *,MS/GAM,BETA,HX,VO,THE,GLAM,SC1,SC2,AH,THES,GLAMS                        00000140
     *,GE/ZK,B1,P1                                                             00000150
     *,OPTION/IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE,OUTINC,IOUT3             00000160
     *,RTD/RTD,RTD6,RTD36,F36,P6080,FERU                                       00000170
     *,SWSW/SWTCH1,SWTCH2                                                      00000180
     *,SW3SW4/SWTCH3,SWTCH4                                                    00000190
     *,SW5SW6/SWTCH5,SWTCH6                                                    00000200
     *,TIME5/TIME5/TIMEL/TIMEL,TIMES                                           00000210
     *,AX/TM,NTRJ/M2TRAJ/XX(11)                                                00000220
      COMMON/NR/NREC1,NREC2,NREC3,NREC4,NREC5,NREC                             00000230
     *,NR6/NREC6/SW10/SWCH10                                                   00000240
     *,IO/IO,IO1,IO2                                                           00000250
     *,INOUT/INCOUT,IQUT,NOFF1,NOFF2,NOFF3,IOUTA                               00000260
      COMMON/NR7/NREC7,NOFF4                                                   00000270
     *,OUTT/OUTTJ(5000)/OUTRJ/OUTTRJ(5000),OUTRAD(5000),OUTPLT(5000)           00000280
     *,SITES/NSITE,SLAT(20),SLONG(20),SALT(20)                                 00000285
      DOUBLE PRECISION T,H,XYZ,RSL,PZ,X,XD,XDD,ZK,B1,P1,GAM,BETA,HX,VO,        00000290
     *THE,GLAM,SC1,SC2,AH,THES,GLAMS,RS,RSD,RSDD,SIG,SIGD,SIGDD,EL,ELD,       00000300
     *ELDD,REGAM,HDBETA,TM,X1,X3,TIMEL,TIMES                                   00000310
     *,XX,SLAT,SLONG,SALT                                                      00000320
                                                                               00000330
      LOGICAL IOUT1,IOUT2,KZ,IPLOT1,IPLOT2,KAT,SPHERE                          00000340
     *,IOUT3                                                                   00000350
      LOGICAL SWITCH,SWTCHR,SWTCH1,SWTCH2,SWTCH3,SWTCH4,SWTCH5,SWTCH6          00000360
     *,EOF8,EOF10,EOF,SWCH10                                                   00000370
      TIME1 = T                                                                00000460
      ISTOR1 = 1                                                               00000470
      IO = 7                                                                   00000480
      IF(IOUT1)IO=13                                                           00000490
      NREC1 = 0                                                                00000500
      ISTOR4=1                                                                 00000505
      IF(NTRJ.NE.2)GO TO 120                                                   00000510
      OUTINC=-OUTINC                                                           00000512
      SWITCH=.FALSE.                                                           00000515
      SWTCHR=.FALSE.                                                           00000517
```

```
  120 IF(NTRJ.EQ.3)OUTINC=-OUTINC                                    00000518
                                                                     00000520
      ENTRY STORTJ                                                   00000530
                                                                     00000540
C     STORE DATA FROM MISSILE/SATELLITE TRAJECTORY FOR PRINT-OUT     00000550
                                                                     00000560
      IOUT = 0                                                       00000570
      TIMES = T                                                      00000577
      OUTTRJ(ISTOR1) = X(1)                                          00000580
      OUTTRJ(ISTOR1+1) = X(2)*RTD                                    00000590
      OUTTRJ(ISTOR1+2) = X(3)*RTD                                    00000600
      OUTTRJ(ISTOR1+3) = H                                           00000610
      OUTTRJ(ISTOR1+4) = XYZ*0. 16666667                             00000620
      OUTTRJ(ISTOR1+5) = ZK                                          00000630
      OUTTRJ(ISTOR1+6) = PZ                                          00000640
      ISTOR1 = ISTOR1 + 7                                            00000650
      NREC1 = NREC1 + 1                                              00000660
      IF(.NOT.IOUT1)RETURN                                           00000670
      OUTTRJ(ISTOR1) = XD(1)*0. 16666667                             00000680
      OUTTRJ(ISTOR1+1) = XD(2)*RTD6                                  00000690
      OUTTRJ(ISTOR1+2) = XD(3)*RTD6                                  00000700
      OUTTRJ(ISTOR1+3) = XDD(1)*F36                                  00000710
      OUTTRJ(ISTOR1+4) = XDD(2)*RTD36                                00000720
      OUTTRJ(ISTOR1+5) = XDD(3)*RTD36                                00000730
      ISTOR1 = ISTOR1 + 6                                            00000740
      RETURN                                                         00000750
                                                                     00000760
      ENTRY STORTR                                                   00000770
                                                                     00000780
C     STORE TRAJECTORY DATA FOR RADAR COMPUTATIONS                   00000790
                                                                     00000800
      NREC7 = NREC7+1                                                00000810
      OUTTJ(ISTOR4)=X(1)                                             00000820
      OUTTJ(ISTOR4+1)=X(2)                                           00000830
      OUTTJ(ISTOR4+2)=X(3)                                           00000840
      OUTTJ(ISTOR4+3)=XD(1)                                          00000850
      OUTTJ(ISTOR4+4)=XD(2)                                          00000860
      OUTTJ(ISTOR4+5)=XD(3)                                          00000870
      OUTTJ(ISTOR4+6)=XDD(1)                                         00000880
      OUTTJ(ISTOR4+7)=XDD(2)                                         00000890
      OUTTJ(ISTOR4+8)=XDD(3)                                         00000900
      ISTOR4= ISTOR4+9                                               00000910
      RETURN                                                         00000920
                                                                     00000930
      ENTRY OUTTRI                                                   00000940
                                                                     00000950
      IREC=1                                                         00000955
      WRITE(9)IREC,TIME1                                             00000960
      RETURN                                                         00000970
                                                                     00000980
      ENTRY OUTTR                                                    00000990
                                                                     00001000
```

```
C       OUTPUT TRAJECTORY DATA ON A FILE                                00001010
                                                                        00001020
        IREC=IREC+1                                                     00001025
        WRITE(9)IREC,NREC7                                              00001030
        IF(NREC7.EQ.0)RETURN                                            00001040
        NDATA = NREC7*9                                                 00001050
        IREC=IREC+1                                                     00001055
        WRITE(9)IREC,(OUTTJ(I),I=1,NDATA)                               00001060
        NREC7 = 0                                                       00001070
        ISTOR4=1                                                        00001080
        RETURN                                                          00001090
                                                                        00001100
        ENTRY STRAD2                                                    00001110
                                                                        00001120
C       COMPUTE SECOND RADAR TIME POINT TO BE PRINTED OUT               00001130
                                                                        00001140
        TIME4 = T/OUTINC                                                00001150
        ITIME = TIME4                                                   00001160
        IF(TIME4-FLOAT(ITIME).LT.1.0E-5)GO TO 80                        00001170
        RETURN                                                          00001180
   80   SWTCH4 = .FALSE.                                                00001190
        IOUTA = INCOUT                                                  00001200
        TIME4 = T                                                       00001210
        NREC6 = 2                                                       00001220
        RETURN                                                          00001230
        ENTRY STORAD                                                    00001240
        TIME2 = T                                                       00001250
        ISTOR2 = 1                                                      00001260
        IO1 = 8                                                         00001270
        IF(IOUT2)IO1=13                                                 00001280
        NREC2 = 0                                                       00001290
        NREC6 = 1                                                       00001300
        ENTRY STORD1                                                    00001310
                                                                        00001320
C       STORE RADAR DATA FROM MISSILE/SATELLITE                         00001330
   90   IOUTA = 0                                                       00001340
        TIME5 = T                                                       00001350
        OUTRAD(ISTOR2) = RS*F608                                        00001360
        OUTRAD(ISTOR2+1) = RSD*0. 16666667                              00001370
        OUTRAD(ISTOR2+2) = EL*RTD                                       00001380
        OUTRAD(ISTOR2+3) = ELD*RTD60                                    00001390
        OUTRAD(ISTOR2+4) = SIG*RTD                                      00001400
        OUTRAD(ISTOR2+5) = SIGD*RTD60                                   00001410
        OUTRAD(ISTOR2+6) = X1*FERU                                      00001420
        OUTRAD(ISTOR2+7) = X3*RTD - GLAMS                               00001430
        ISTOR2 = ISTOR2 + 8                                             00001440
        NREC2 = NREC2 + 1                                               00001450
        IF(.NOT.IOUT2)RETURN                                            00001460
        OUTRAD(ISTOR2) = RSDD*F36                                       00001470
        OUTRAD(ISTOR2+1) = ELDD*RTD36                                   00001480
        OUTRAD(ISTOR2+2) = SIGDD*RTD36                                  00001490
        OUTRAD(ISTOR2+3) = R2GAM*RTD                                    00001500
```

```
      OUTRAD(ISTOR2+4) = HDBETA*RTD                                     00001510
      ISTOR2 = ISTOR2 + 5                                               00001520
      RETURN                                                            00001530
      ENTRY STRADL                                                      00001540
                                                                        00001550
C     DETERMINE LAST RADAR TIME POINT FOR STORAGE AND PRINT-OUT         00001560
                                                                        00001570
      IF(TIME8.LT.TIME5+0.01)RETURN                                     00001580
      TIME6 = TIME8                                                     00001590
      NREC6 = 3                                                         00001600
      GO TO 90                                                          00001610
                                                                        00001620
      ENTRY PRINTT                                                      00001630
                                                                        00001640
C     OUTPUT TRAJECTORY DATA                                            00001650
                                                                        00001660
      IF(NREC1.EQ.0)GO TO 5                                             00001670
      IO11 = IO - 1                                                     00001680
      MOD52 = MOD(NREC1,52)*IO                                          00001690
      NPAGE = NREC1/52 + 1                                              00001700
      IF(MOD52.EQ.0)NPAGE=NPAGE-1                                       00001710
      K52 = 52*IO                                                       00001720
      IF(NTRJ.NE.2)GO TO 85                                             00001721
      IF(SWITCH)GO TO 85                                                00001722
      SWITCH=.TRUE.                                                     00001723
      IF(TIME2-TIME1.EQ.OUTINC)GO TO 85                                 00001724
      SWTCHR=.TRUE.                                                     00001725
   85 DO 40 NP=1,NPAGE                                                  00001730
      IEND = NP*K52                                                     00001740
      ISTART = (NP-1)*K52 + 1                                           00001750
      IF(SWTCHR)GO TO 18                                                00001755
      IF(NP.NE.NPAGE)GO TO 30                                           00001760
      IF(MOD52.EQ.0)GO TO 30                                            00001770
      IF(NPAGE.EQ.1)GO TO 50                                            00001780
      IEND = ISTART -1 + MOD52                                          00001790
   30 IF(IOUT1)GO TO 35                                                 00001800
      WRITE(6,10)NTRJ,(TIME1+(I/IO)*OUTINC,(OUTTRJ(J),J=I,I+IO11),I=ISTA00001810
     *RT,IEND,IO)                                                       00001820
   10 FORMAT(1H1,1X,41HTRAJECTORY PARAMETERS , TRAJECTORY NUMBER,I4//5X00001830
     *, 9HTIME(MIN),2X,10HRADIUS(FT),2X,13HLATITUDE(DEG),2X,14HLONGITUDE00001840
     *(DEG),2X,10HHEIGHT(FT),2X,14HVELOCITY(FT/S),2X,21HBAL.COEFF.(FT**200001850
     */SLG),2X,22HATMOS.DENS.(SLG/FT**3)/(6X,F7.2,1X,E12.5,3X,F7.2,8X,F800001860
     *.2,5X,E12.5,3X,E13.6,4X,E12.5,12X,E12.5))                          00001870
      GO TO 40                                                          00001880
   50 IEND = MOD52                                                      00001890
      GO TO 30                                                          00001900
   35 WRITE(6,15)NTRJ,(TIME1+(I/IO)*OUTINC,(OUTTRJ(J),J=I,I+IO11),I=ISTA00001910
     *RT,IEND,IO)                                                       00001920
   15 FORMAT(1H1,1X,41HTRAJECTORY PARAMETERS , TRAJECTORY NUMBER,I4//3X00001930
     *,4HTIME,4X,6HRADIUS,1X,8HLATITUDE,1X,9HLONGITUDE,4X,6HHEIGHT,3X,8H00001940
     *VELOCITY,2X,6HBALCOF,2X,5HATDEN,5X,5HR-DOT,1X,7HLAT-DOT,1X,8HLONG-00001950
     *DOT,2X,8HR-DOTDOT,1X,10HLAT-DOTDOT,1X,11HLONG-DOTDOT/2X,5H(MIN),5X00001960
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```
     *,4H(FT),4X,5H(DEG),4X,5H(DEG),7X,4H(FT),5X,6H(FT/S),2X,7H(F2/SQ),10000197
     *X,7H(SQ/F3),3X,6H(FT/S),1X,7H(DEG/S),2X,7H(DEG/S),1X,9H(FT/S**2),10000198
     *X,10H(DEG/S**2),2X,10H(DEG/S**2)/(1X,F6.2,1X,E9.3,2X,F7.2,2X,F8.2,00001990
     *1X,E9.3,1X,E10.3,1X,F5.2,E9.2,E10.3,1X,F7.4,1X,F8.5,2X,F8.4,1X,    00002000
     *E10.3,2X,E10.3)                                                    00002010
      GO TO 40                                                           00002020
C                                                                        00002030
C     PRINT OUT 1ST,2ND,& FOLLOWING TIME POINTS FOR 2ND TRAJECTORY       00002040
C                                                                        00002050
  180 SWTCHR=.FALSE.                                                     00002060
      IF(NPAGE.NE.1)GO TO 240                                            00002070
      IF(MOD52.EQ.0)GO TO 240                                            00002080
      IEND=MOD52                                                         00002090
  240 IF(IOUT1)GO TO 245                                                 00002100
      WRITE(6,10)NTRJ,TIME1,(OUTTRJ(J),J=1,IO)                           00002110
      ISTRT=ISTART+IO                                                    00002120
      WRITE(6,60)(TIME2+((I-IO)/IO)*OUTINC,(OUTTRJ(J),J=I,               00002130
     *I+IO-1),I=ISTRT,IEND,IO)                                           00002140
  255 TIME1=TIME2-OUTINC                                                 00002150
      GO TO 40                                                           00002160
  245 WRITE(6,15)NTRJ,TIME1,(OUTTRJ(J),J=1,IO)                           00002170
      ISTRT=ISTART+IO                                                    00002180
      WRITE(6,75)(TIME2+((I-IO)/IO)*OUTINC,(OUTTRJ(J),J=I,               00002190
     *I+IO-1),I=ISTRT,IEND,IO)                                           00002200
      GO TO 255                                                          00002210
   40 CONTINUE                                                           00003000
      TIME1 = TIME1 + (IEND/IO)*OUTINC                                   00003010
    5 IF(SWTCH3)GO TO 2                                                  00003020
      ISTOR1 = 1                                                         00003030
      NREC1 = 0                                                          00003040
   65 TIMEL=T                                                            00003050
      RETURN                                                             00003060
                                                                         00003070
C     PRINT OUT LAST TIME POINT                                          00003080
                                                                         00003090
   20 IF(NTRJ.NE.2)GO TO 21                                              00003100
      IF(T.GT.TIMES-0.01D0)GO TO 65                                      00003110
      GO TO 22                                                           00003120
   21 IF(T.LT.TIMES+0.01D0)GO TO 65                                      00003130
   22 OUTTRJ(1) = X(1)                                                   00003140
      OUTTRJ(2) = X(2)*RTD                                               00003150
      OUTTRJ(3) = X(3)*RTD                                               00003160
      OUTTRJ(4) = H                                                      00003170
      OUTTRJ(5) = XYZ*0.16666667                                         00003180
      OUTTRJ(6) = ZK                                                     00003190
      OUTTRJ(7) = PZ                                                     00003200
      IF(.NOT.IOUT1)GO TO 25                                             00003210
      OUTTRJ(8) = XD(1)*0.16666667                                       00003220
      OUTTRJ(9) = XD(2)*RTD60                                            00003230
      OUTTRJ(10) = XD(3)*RTD60                                           00003240
      OUTTRJ(11) = XDD(1)*F36                                            00003250
      OUTTRJ(12) = XDD(2)*RTD36                                          00003260
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      OUTTRJ(13) = XDD(3)*RTD36                                          0000327
      GO TO 45                                                           0000328
   25 IF(MOD52.EQ. )GO TO 55                                             0000329
      WRITE(6,6 )T,(OUTTRJ(J),J=1,IO)                                    0000330
   60 FORMAT(6X,F7.2,1X,E12.5,3X,F7.2,8X,F8.2,5X,E12.5,3X,E13.6,4X,E12.5,0000331
     *,12X,E12.5)                                                        0000332
      GO TO 65                                                           0000333
   55 WRITE(6,1 )NTRJ,T,(OUTTRJ(J),J=1,IO)                               0000334
      GO TO 65                                                           0000335
   45 IF(MOD52.EQ. )GO TO 70                                             0000336
      WRITE(6,75)T,(OUTTRJ(J),J=1,IO)                                    0000337
   75 FORMAT(1X,F6.2,1X,E9.3,2X,F7.2,2X,F8.2,1X,E9.3,1X,E10.3,1X,F5.2,   0000338
     *,E9.2,E1 .3,1X,F7.4,1X,F8.5,2X,F8.4,1X,E10.3,2X,E10.3)             0000339
      GO TO 65                                                           0000340
   70 WRITE(6,15)NTRJ,T,(OUTTRJ(J),J=1,IO)                               0000341
      GO TO 65                                                           0000342
                                                                         0000343
      ENTRY OUTRDR                                                       0000344
C     OUTPUT RADAR DATA ON FILE                                          0000345
      EOF8 = .FALSE.                                                     0000346
      WRITE(08)NREC2,NREC6,EOF8                                          0000347
      IF(NREC2.EQ. )RETURN                                               0000348
      IF(NREC6.EQ.1.OR.NREC6.EQ.2)WRITE(08)TIME2,TIME4                   0000349
      IF(NREC6.EQ. )GO TO 95                                             0000350
      IF(NREC6.EQ.3)WRITE( 8)TIME2,TIME4,TIME6                           0000351
   95 NREC = NREC2*IO1                                                   0000352
      WRITE(08)(OUTRAD(I),I=1,NREC)                                      0000353
      ISTOR2 = 1                                                         0000354
      NREC2 = 0                                                          0000355
      NREC6 = 0                                                          0000356
      RETURN                                                             0000357
      ENTRY OUTEOF                                                       0000358
      EOF8 = .TRUE.                                                      0000359
      WRITE(08)NREC2,NREC6,EOF8                                          0000360
      RETURN                                                             0000361
      ENTRY PRINTR                                                       0000362
C     OUTPUT RADAR DATA ON PRINTER                                       0000363
      REWIND 8                                                           0000364
      IO11 = IO1 - 1                                                     0000365
  140 SWITCH = .TRUE.                                                    0000366
      SWITCHR = .FALSE.                                                  0000367
    8 READ(08)NREC2,NREC6,EOF8                                           0000368
      IF(EOF8)GO TO 14                                                   0000369
      IF(NREC2.EQ. )GO TO 300                                            0000370
      NREC = NREC2*IO1                                                   0000371
      IF(NREC6.EQ.1.OR.NREC6.EQ.2)READ(08)TIME2,TIME4                    0000372
      IF(NREC6.EQ. )GO TO 130                                            0000373
      IF(NREC6.EQ.3.AND.SWITCH)READ(08)TIME2,TIME4,TIME6                 0000374
      IF(NREC6.EQ.3.AND.(.NOT.SWITCH))READ(08)DUM,DUM,TIME6              0000375
  130 READ(08)(OUTRAD(I),I=1,NREC)                                       0000376
      MOD52 = MOD(NREC2,52)*IO1                                          0000377
      NPAGE = NREC2/52 + 1                                               0000378
```

```
      IF(MOD52.EQ.0)NPAGE=NPAGE-1                                       00003790
      K52 = 52*IO1                                                      00003800
      DO 110 NP=1,NPAGE                                                 00003810
      IEND = NP*K52                                                     00003820
      ISTART = (NP-1)*K52 + 1                                           00003830
      IF(NP.EQ.1)GO TO 150                                              00003840
  160 IF(NP.EQ.NPAGE)GO TO 155                                          00003850
      IF(NP.NE.NPAGE)GO TO 105                                          00003860
  200 IF(MOD52.EQ.0)GO TO 105                                           00003870
      IF(NPAGE.EQ.1)GO TO 115                                           00003880
      IEND = ISTART -1 + MOD52                                          00003890
  105 IF(IOUT2)GO TO 10                                                 00003900
      WRITE(6,125)NTRJ,ISITE,SC1,SC2,(TIME2+(I/IO1)*OUTINC,             00003910
     *I,OUTRAD(J),J=I,I+IO11),I=ISTART,IEND,IO1)                        00003920
  125 FORMAT(1H1,10X,36HRADAR PARAMETERS , TRAJECTORY NUMBER,I4,3X,10HRA 00003930
     *DAR SITE,I4,F12.3," DEG.LAT.",F12.3," DEG.LONG." //5X,"TIME",7X,8H00003940
     *SL RANGE,4X,13HSL RANGE-RATE,3X,9HELEVATION,7X,7HEL RATE,4X,7HAZIM00003950
     *UTH,6X,7HAZ RATE,4X,6HRADIUS,4X,12HINERTIAL PHI/4X,5H(MIN),10X,4H(00003960
     *NM),8X,6H(FT/S),9X,5H(DEG),9X,7H(DEG/S),5X,5H(DEG),7X,7H(DEG/S),4X00003970
     *,5H(ERU),9X,5H(DEG)/(2X,F7.2,2X,E13.6,4X,E13.6,5X,F7.2,3X,E11.4,4X00003980
     *,F7.2,2X,E11.4,3X,F7.3,9X,F7.2))                                  00003990
      GO TO 110                                                         00004000
  115 IEND = MOD52                                                      00004010
      GO TO 105                                                         00004020
  100 WRITE(6,135)NTRJ,ISITE,SC1,SC2,(TIME2+(I/IO1)*OUTINC,             00004030
     *I,OUTRAD(J),J=I,I+IO11),I=ISTART,IEND,IO1)                        00004040
  135 FORMAT(1H1,10X,36HRADAR PARAMETERS , TRAJECTORY NUMBER,I4,3X,10HRA 00004050
     *DAR SITE,I4,F12.3," DEG.LAT.",F12.3," DEG.LONG." //3X,"TIME",2X,8H00004060
     *SL-RANGE,1X,11HSL-RANGE-RT,1X,9HELEVATION,4X,7HEL-RATE,1X,7HAZIMUT00004070
     *H,5X,7HAZ-RATE,2X,6HRADIUS,1X,7HINR-PHI,1X,7HSL-RTRT,4X,7HEL-RTRT,00004080
     *4X,7HAZ-RTRT,1X,7HREENTRY,1X,7HHEADING/2X,5H(MIN),5X,4H(NM),5X,6H(00004090
     *FT/S),5X,5H(DEG),6X,7H(DEG/S),2X,5H(DEG),6X,7H(DEG/S),3X,5H(ERU),200004100
     *X,5H(DEG),1X,8H(FT/S/S),2X,9H(DEG/S/S),2X,9H(DEG/S/S),2X,5H(DEG),300004110
     *X,5H(DEG)/(1X,F6.2,1X,E9.3,1X,E11.4,3X,F7.2,1X,E10.3,1X,F7.2,1X,E100004120
     *1.4,1X,F7.3,1X,F7.2,1X,F7.3,1X,E10.3,1X,E10.3,1X,F7.2,1X,F7.2))   00004130
      GO TO 110                                                         00004140
                                                                        00004150
C     PRINT OUT FIRST,SECOND AND FOLLOWING TIME POINTS                  00004160
                                                                        00004170
  150 IF(SWITCH)GO TO 145                                               00004180
      GO TO 160                                                         00004190
  145 IF(NPAGE.EQ.1)GO TO 165                                           00004200
  195 IF(IOUT2)GO TO 17                                                 00004210
      WRITE(6,125)NTRJ,ISITE,SC1,SC2,TIME2,(OUTRAD(J),J=1,IO1)          00004220
      ISTRT = ISTART + IO1                                              00004230
      WRITE(6,175)(TIME4+((I-IO1)/IO1)*OUTINC,(OUTRAD(J),J=I,I+IO11),I= 00004240
     *ISTRT,IEND,IO1)                                                   00004250
  175 FORMAT(2X,F7.2,2X,E13.6,4X,E13.6,5X,F7.2,3X,E11.4,4X,F7.2,2X,E11.400004260
     *,3X,F7.3,9X,F7.2)                                                 00004270
      IF(SWTCHR)WRITE(6,175)TIMES,(OUTRAD(J),J=IEND+1,IEND+IO1)         00004280
  190 TIME2 = TIME4 = OUTINC                                            00004290
      GO TO 110                                                         00004300
```

```
  170 WRITE(6,135)NTRJ,ISITE,SC1,SC2,TIME2,(OUTRAD(J),J=1,IO1)          00004310
      ISTRT = ISTART + IO1                                              00004320
      WRITE(6,185)(TIME2+((I-IO1)/IO1)*OUTINC,(OUTRAD(J),J=I,I+IO11),I= 00004330
     *ISTRT,IEND,IO1)                                                   00004340
  185 FORMAT(1X,F6.2,1X,E9.3,1X,E11.4,3X,F7.2,1X,E10.3,1X,F7.2,1X,E11.4, 00004350
     *1X,F7.3,1X,F7.2,1X,F7.3,1X,E10.3,1X,E10.3,1X,F7.2,1X,F7.2)         00004360
      IF(SWTCHR)WRITE(6,185)TIME6,(OUTRAD(J),J=IEND+1,IEND+IO1)         00004370
      GO TO 190                                                         00004380
  165 IF(NREC6.NE.3)GO TO 196                                           00004390
      SWTCHR = .TRUE.                                                   00004400
      IEND = IEND - IO1                                                 00004410
      IF(MOD52.NE.0)IEND=MOD52-IO1                                      00004420
      GO TO 195                                                         00004430
  196 IF(MOD52.NE.0)IEND=MOD52                                          00004432
      GO TO 195                                                         00004434
                                                                        00004440
C     PRINT OUT LAST TIME POINT                                         00004450
  155 IF(NREC6.NE.3)GO TO 200                                           00004460
      IF(MOD52.EQ.0)GO TO 205                                           00004470
      IF(NPAGE.EQ.1)GO TO 210                                           00004480
      IEND = ISTART + 1 + MOD52 - IO1                                   00004490
  230 IF(IOUT2)GO TO 22                                                 00004500
      IF(IEND.LE.ISTART)GO TO 215                                       00004510
      WRITE(6,125)NTRJ,ISITE,SC1,SC2,(TIME2+(I/IO1)*OUTINC,             00004520
     *(OUTRAD(J),J=I,I+IO11),I=ISTART,IEND,IO1)                         00004530
      WRITE(6,175)TIME6,(OUTRAD(J),J=IEND+1,IEND+IO1)                   00004540
      GO TO 110                                                         00004550
  215 WRITE(6,125)NTRJ,ISITE,SC1,SC2,TIME6,(OUTRAD(J),J=                00004560
     *ISTART,ISTART+IO11)                                               00004570
      GO TO 110                                                         00004580
  220 IF(IEND.LE.ISTART)GO TO 225                                       00004590
      WRITE(6,135)NTRJ,ISITE,SC1,SC2,(TIME2+(I/IO1)*OUTINC,             00004600
     *(OUTRAD(J),J=I,I+IO11),I=ISTART,IEND,IO1)                         00004610
      WRITE(6,185)TIME6,(OUTRAD(J),J=IEND+1,IEND+IO1)                   00004620
      GO TO 110                                                         00004630
  225 WRITE(6,135)NTRJ,ISITE,SC1,SC2,TIME6,(OUTRAD(J),J=                00004640
     *ISTART,ISTART+IO11)                                               00004650
      GO TO 110                                                         00004660
  205 IEND = IEND - IO1                                                 00004670
      GO TO 230                                                         00004680
  210 IEND = MOD52 - IO1                                                00004690
      GO TO 230                                                         00004700
  110 CONTINUE                                                          00004710
      SWITCH = .FALSE.                                                  00004720
      SWTCHR = .FALSE.                                                  00004730
      TIME2 = TIME2 + (IEND/IO1)*OUTINC                                 00004740
      GO TO 8                                                           00004750
  300 REWIND 8                                                          00004760
      RETURN                                                            00004770
      ENTRY NOTVIS                                                      00004780
      WRITE(6,250)NTRJ,ISITE,SC1,SC2                                    00004790
  250 FORMAT(1H1///10X,"OBJECT NOT VISIBLE TO RADAR"//10X,              00004800
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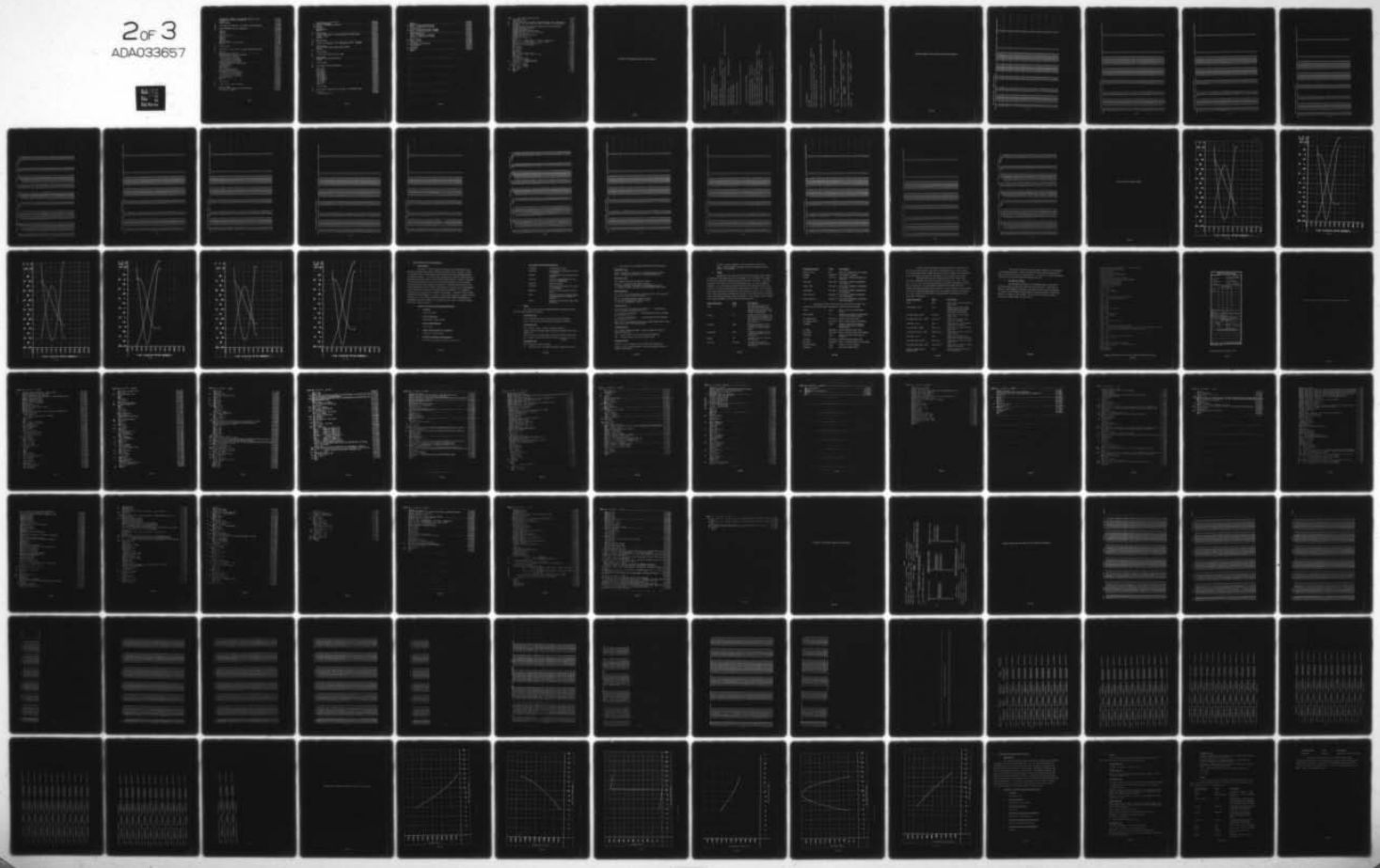
AD-A033 657 PRC INFORMATION SCIENCES CO ROME N Y F/G 15/3
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 1, PART 1, BOOK 1, --ETC(U)
OCT 76 P R CONTI F30602-75-C-0167
UNCLASSIFIED RADC-TR-76-261-VOL-1-PT-1- NL

2 OF 3
ADA033657



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     *"TRAJECTORY NUMBER",I4,5X,"RADAR SITE",I4,F12.3,                  00004810
     *" DEG.LAT.",F12.3," DEG.LONG."/)                                  00004820
      RETURN                                                            00004830
      ENTRY PLTAPE                                                      00004840
C                                                                       00004850
C     GENERATE DATA TAPE/FILE FOR INPUT TO PLOT PROGRAMS                00004860
C                                                                       00004870
C     INITIALIZATION FOR PLOT TAPE/FILE                                 00004880
C                                                                       00004890
      TIME3=T                                                           00004900
      ISTOR3=1                                                          00004910
      IO2=8                                                             00004920
      IF(IPLOT2)IO2=13                                                  00004930
      NREC3=0                                                           00004940
      NREC4=0                                                           00004950
      NREC5=0                                                           00004960
      EOF=.FALSE.                                                       00004970
      WRITE(10)TIME3,IPLOT2,IO2,EOF                                     00004980
      RETURN                                                            00004990
C                                                                       00005000
      ENTRY STORTP                                                      00005010
C                                                                       00005020
C     TEMPORARILY STORE RADAR DATA FROM MISSILE/SATELLITE               00005030
C                                                                       00005040
      TIME7=T                                                           00005050
      OUTPLT(ISTOR3)=RS*F6.80                                           00005060
      OUTPLT(ISTOR3+1)=RSD*0.016666667                                  00005070
      OUTPLT(ISTOR3+2)=EL*RTD                                           00005080
      OUTPLT(ISTOR3+3)=ELD*RTD60                                        00005090
       OUTPLT(ISTOR3+4)=SIG*RTD                                         00005100
       OUTPLT(ISTOR3+5)=SIGD*RTD60                                      00005110
      OUTPLT(ISTOR3+6)=X(1)*FERU                                        00005120
      OUTPLT(ISTOR3+7)=X(3)*RTD-GLAMS                                   00005130
      ISTOR3=ISTOR3+8                                                   00005140
      NREC3=NREC3+1                                                     00005150
      NREC4=NREC4+1                                                     00005160
      IF(.NOT.IPLOT2)RETURN                                             00005170
      OUTPLT(ISTOR3)=RSDD*F36                                           00005180
      OUTPLT(ISTOR3+1)=ELDD*RTD36                                       00005190
      OUTPLT(ISTOR3+2)=SIGDD*RTD36                                      00005200
      OUTPLT(ISTOR3+3)=REGAM*RTD                                        00005210
      OUTPLT(ISTOR3+4)=HDBETA*RTD                                       00005220
      ISTOR3=ISTOR3+5                                                   00005230
      RETURN                                                            00005240
C                                                                       00005250
      ENTRY PLTAP1                                                      00005260
C                                                                       00005270
C     OUTPUT DATA ON PLOT TAPE/FILE                                     00005280
C                                                                       00005290
      EOF10=.FALSE.                                                     00005300
      WRITE(10)NREC3,NREC4,NREC5,EOF10,SWTCH2                           00005310
      IF(NREC3.EQ.0)RETURN                                              00005320
```

```
      IF(NREC3.EQ.(-1))GO TO 235                                        00005330
      NDATA = NREC3*IO2                                                 00005340
      WRITE(10)(OUTPLT(I),I=1,NDATA)                                    00005350
  235 NREC3=0                                                           00005360
      ESTOR3=1                                                          00005370
      NREC5=NREC5+1                                                     00005380
      RETURN                                                            00005390
C                                                                       00005400
      ENTRY PLTEND                                                      00005410
C      OUTPUT LAST TIME OF MISSILE SIGHTING BY RADAR SITE               00005420
      WRITE(10)TIME7                                                    00005430
      RETURN                                                            00005440
C                                                                       00005450
      ENTRY PLTAP2                                                      00005460
C                                                                       00005470
C     OUTPUT LAST RECORD ON PLOT TAPE/FILE FOR ONE  SIGHTING            00005480
C                                                                       00005490
      EOF10=.TRUE.                                                      00005500
      WRITE(10)NREC3,NREC4,NREC5,EOF10,SWTCH2                           00005510
      RETURN                                                            00005520
C                                                                       00005530
      ENTRY PLTAP3                                                      00005540
C                                                                       00005550
C     OUTPUT FINAL RECORD ON PLOT FILE                                  00005560
C                                                                       00005570
      EOF=.TRUE.                                                        00005580
      WRITE(10)TIME3,IPLOT2,IO2,EOF                                     00005590
      RETURN                                                            00005600
C                                                                       00005610
      ENTRY STORT2                                                      00005620
C                                                                       00005630
C     STORE DATA FOR 2ND TRAJECTORY                                     00005640
C                                                                       00005650
      XX(1)=X(1)                                                        00005660
      XX(2)=X(2)                                                        00005670
      XX(3)=X(3)                                                        00005680
      XX(4)=XD(1)                                                       00005690
      XX(5)=XD(2)                                                       00005700
      XX(6)=XD(3)                                                       00005710
      XX(7)=XDD(1)                                                      00005720
      XX(8)=XDD(2)                                                      00005730
      XX(9)=XDD(3)                                                      00005740
      XX(10)=ZK                                                         00005742
      XX(11)=PZ                                                         00005744
      RETURN                                                            00005750
C                                                                       00005760
      ENTRY OUTNOM                                                      00005770
C                                                                       00005780
C    PLACE NOMINAL TRAJECTORY RADAR DATA ON A SEPARATE FILE             00005790
C                                                                       00005800
      ISITE =1                                                          00005810
      IF(.NOT.KZ)GO TO 4 0                                              00005820
```

```
      REWIND 10                                                         00005830
      REWIND 11                                                         00005840
  440 READ(10)TIME3,IPLOT3,IO2,EOF                                      00005850
      WRITE(11)TIME3,IPLOT2,IO2,EOF                                     00005860
      IF(EOF)GO TO 41                                                   00005870
  430 READ(10)NREC3,ITR,IS,EOF10,SWTCH2                                 00005880
      WRITE(11)NREC3,ITR,IS,EOF10,SWTCH2                                00005890
      IF(EOF10)GO TO 42                                                 00005900
      NDATA =NREC3*IO2                                                  00005910
      READ(10)(OUTPLT(I),I=1,NDATA)                                     00005920
      WRITE(11)(OUTPLT(I),I=1,NDATA)                                    00005930
      GO TO 430                                                         00005940
  420 READ(10)TIME7                                                     00005950
      WRITE(11)TIME7                                                    00005960
      GO TO 440                                                         00005970
  410 IF(ISITE.EQ.NSITE)RETURN                                          00005980
      ISITE=ISITE+1                                                     00005990
      GO TO 440                                                         00006000
  400 CONTINUE                                                          00006010
      RETURN                                                            00006015
      END                                                               00006020
```

```
CRKG        4TH ORDER RUNGE-KUTTA-GILL                                    00002170
      SUBROUTINE RKG                                                      00002180
C     INPUT/OUTPUT MOD 1                                                  00002190
C     THIS ROUTINE IS A 4TH ORDER RUNGE-KUTTA-GILL WHICH NUMERICALLY      00002200
C     INTEGRATES THE 2ND ORDER NON-LINEAR DIFFERENTIAL EQUATIONS OF       00002210
C     MOTION.                                                             00002220
      DOUBLE PRECISION C,F,D,A,B,DEG,DXN,DXDX,DL,SAD,ABLE,BAKER           00002230
      DOUBLE PRECISION X,XD,XDD                                           00002240
      DOUBLE PRECISION P,Q                                                00002250
      DOUBLE PRECISION P1,ZK,B1,TWOPI                                     00002260
      DIMENSION C(4), F(4), D(4), A(3),B(3)                               00002270
      DOUBLE PRECISION TO                                                 00002280
      COMMON /BS/ X(3),XD(3),XDD(3)                                       00002290
      COMMON/GE/ZK,B1,P1                                                  00002300
      COMMON /ST/ P(3), Q(3)                                              00002310
     *,TO/TO                                                              00002320
      DATA C/0.5D0,.2928932188,1.7071067811,.1666666667/                  00002330
      DATA D/0.5D0,.2928932188,1.707106781,0.5D0/                         00002340
      DATA F/2.0D0,1.0D0,1.0D0,2.0D0/,                                    00002350
     *TWOPI/6.283185307179586 48/                                         00002360
      DO 10 J=1,4                                                         00002370
      CALL EQTNX                                                          00002380
      DO 10 I=1,3                                                         00002390
      A(I)=XD(I)                                                          00002400
      B(I)=XDD(I)                                                         00002410
      DXN =(A(I)-F(J)*Q(I))*C(J)                                          00002420
      DXDX = (B(I) - F(J) * P(I)) * C(J)                                  00002430
      DL=TO*DXN                                                           00002440
      X(I)=X(I)+DL                                                        00002450
      XD(I)=XD(I)+TO*DXDX                                                 00002460
      Q(I)=Q(I)+3.0D0*DXN-D(J)*A(I)                                       00002470
10    P(I)=P(I)+3.0D0*DXDX-D(J)*B(I)                                      00002480
      IF(X(3))   13,14,14                                                 00002490
   13 X(3) = X(3) +TWOPI                                                  00002500
   14 SAD = X(3) - TWOPI                                                  00002510
      IF ( SAD ) 12,11,11                                                 00002520
   11 X(3) = SAD                                                          00002530
12    RETURN                                                              00002540
      END                                                                 00002550
```

Listing of the Sample Input for the Program

MISSILE TRAJECTORY PROGRAM(MULTIPLE SITE/TRAJECTORY MOD) INPUTS

PROGRAM CONTROLS

NUMBER OF TRAJECTORIES SIMULATED(NTRAJ) 10

MAXIMUM TIME FOR A TRAJECTORY(TM) 0.20000D 02 MIN.

MAIN PROCESSING SWITCH(NSWTCH) 1

PRINT-OUT OPTION 1(IOUT1) F PRINT-OUT OPTION 2(IOUT2) F

INCREMENT BETWEEN TIME POINTS FOR PRINT-OUT(OUTINC) 0.100 MIN.

PRINTOUT OPTION FOR RADAR PARAMETER DIFFERENCES(IOUT3) F NOMINAL TRAJECTORY SELECTION SWITCH(KZ) T

PLOTTING OPTION 1(IPLOT1) T PLOTTING OPTION 2(IPLOT2) F

ATMOSPHERIC MODEL OPTION(KAT) F

SPHERICAL EARTH MODEL(SPHERE) T

INERTIAL VELOCITY OPTION(INERTL) T

****

INITIAL STATE VECTOR OF THE INTERCEPTOR

RE-ENTRY ANGLE WRT THE VERTICAL(GAM) 0.90000D 02 DEG.

HEADING ANGLE WRT RELATIVE NORTH(BETA) 0.81826D 02 DEG.

HEIGHT OF MISSILE AT BURNOUT(HX) 0.60813D 06 FT.

VELOCITY OF MISSILE RELATIVE TO BURNOUT AT EPOCH(VO) 0.25567420000D 05 FT./SEC.

GEOCENTRIC LATITUDE AT BURNOUT, +NORTH AND -SOUTH OF EQUATOR(THE) 0.62700D 02 DEG.

GEOCENTRIC LONGITUDE,EAST OF GREENWICH(GLAM) 0.40350D 02 DEG.

SUBSATELLITE PARAMETERS

GEOCENTRIC LATITUDE, +NORTH AND -SOUTH OF EQUATOR(THES) -0.40000D 02 DEG.

GEOCENTRIC LONGITUDE,EAST OF GREENWICH(GLAMS) 0.60000D 02 DEG.

****

RADAR PARAMETERS

SITE NUMBER 1

GEOCENTRIC LATITUDE OF RADAR, +NORTH AND -SOUTH OF EQUATOR(SLAT) 0.35900D 02 DEG.

GEOCENTRIC LONGITUDE OF RADAR, WEST OF GREENWICH(SLONG) 0.23333D 03 DEG.

ALTITUDE OF RADAR ABOVE SEA LEVEL(SALT) 0. FT.

MAXIMUM CO-LATITUDE OF ELEVATION ANGLE FOR WHICH COVERAGE PARAMETERS ARE DETERMINED(ELIM) 0.89000D 02 DEG.

****

VELOCITY PERTURBATIONS

OUT OF TRAJECTORY PLANE PERTURBATION, +EJECTED TO THE LEFT OF NOMINAL TRAJECTORY(A) IN FT./SEC.

0. 0. 0. 0. 0.50000D 01
0.35330D 01 0.35330D 01

IN PLANE PERTURBATION, +EJECTED BACKWARDS FROM NOMINAL TRAJECTORY(B) IN FT./SEC.

0. 0.50000D 01 0.35330D 01 -0.35330D 01 0.
0.35330D 01 -0.35330D 01

IN PLANE PERTURBATION, +EJECTED UPWARDS FROM NOMINAL TRAJECTORY(C) IN FT./SEC.

0.50000D 01 0. 0.35330D 01 0.35330D 01 0.
0. 0.

Sample Output for the RADC Trajectory Program

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 1

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
0.	0.21534E 08	62.72	40.35	0.60803E 06	0.25567E 05	0.	0.
0.10	0.21534E 08	62.76	41.21	0.60803E 06	0.25567E 05	0.	0.
0.20	0.21534E 08	62.82	42.07	0.60803E 06	0.25567E 05	0.	0.
0.30	0.21534E 08	62.85	42.93	0.60803E 06	0.25567E 05	0.	0.
0.40	0.21534E 08	62.89	43.80	0.60803E 06	0.25567E 05	0.	0.
0.50	0.21534E 08	62.92	44.67	0.60803E 06	0.25567E 05	0.	0.
0.60	0.21534E 08	62.95	45.54	0.60803E 06	0.25567E 05	0.	0.
0.70	0.21534E 08	62.97	46.41	0.60803E 06	0.25567E 05	0.	0.
0.80	0.21534E 08	62.99	47.28	0.60803E 06	0.25567E 05	0.	0.
0.90	0.21534E 08	63.00	48.15	0.60803E 06	0.25567E 05	0.	0.
1.00	0.21534E 08	63.01	49.03	0.60803E 06	0.25567E 05	0.	0.
1.10	0.21534E 08	63.00	49.90	0.60803E 06	0.25567E 05	0.	0.
1.20	0.21534E 08	62.99	50.77	0.60803E 06	0.25567E 05	0.	0.
1.30	0.21534E 08	62.98	51.65	0.60803E 06	0.25567E 05	0.	0.
1.40	0.21534E 08	62.96	52.52	0.60803E 06	0.25567E 05	0.	0.
1.50	0.21534E 08	62.94	53.39	0.60803E 06	0.25567E 05	0.	0.
1.60	0.21534E 08	62.91	54.26	0.60803E 06	0.25567E 05	0.	0.
1.70	0.21534E 08	62.87	55.13	0.60803E 06	0.25567E 05	0.	0.
1.80	0.21534E 08	62.83	55.99	0.60803E 06	0.25567E 05	0.	0.
1.90	0.21534E 08	62.78	56.85	0.60803E 06	0.25567E 05	0.	0.
2.00	0.21534E 08	62.73	57.71	0.60803E 06	0.25567E 05	0.	0.
2.10	0.21534E 08	62.67	58.57	0.60803E 06	0.25567E 05	0.	0.
2.20	0.21534E 08	62.61	59.42	0.60803E 06	0.25567E 05	0.	0.
2.30	0.21534E 08	62.54	60.27	0.60803E 06	0.25567E 05	0.	0.
2.40	0.21534E 08	62.47	61.12	0.60803E 06	0.25567E 05	0.	0.
2.50	0.21534E 08	62.39	61.96	0.60803E 06	0.25567E 05	0.	0.
2.60	0.21534E 08	62.3	62.79	0.60803E 06	0.25567E 05	0.	0.
2.70	0.21534E 08	62.21	63.62	0.60803E 06	0.25567E 05	0.	0.
2.80	0.21534E 08	62.12	64.45	0.60803E 06	0.25567E 05	0.	0.
2.90	0.21534E 08	62.02	65.27	0.60803E 06	0.25567E 05	0.	0.
3.00	0.21534E 08	61.91	66.08	0.60803E 06	0.25567E 05	0.	0.
3.10	0.21534E 08	61.80	66.89	0.60803E 06	0.25567E 05	0.	0.
3.20	0.21534E 08	61.69	67.69	0.60803E 06	0.25567E 05	0.	0.
3.30	0.21534E 08	61.57	68.48	0.60803E 06	0.25567E 05	0.	0.
3.40	0.21534E 08	61.44	69.27	0.60803E 06	0.25567E 05	0.	0.
3.50	0.21534E 08	61.31	70.06	0.60803E 06	0.25567E 05	0.	0.
3.60	0.21534E 08	61.17	70.83	0.60803E 06	0.25567E 05	0.	0.
3.70	0.21534E 08	61.03	71.60	0.60803E 06	0.25567E 05	0.	0.
3.80	0.21534E 08	60.89	72.36	0.60803E 06	0.25567E 05	0.	0.
3.90	0.21534E 08	60.74	73.12	0.60803E 06	0.25567E 05	0.	0.
4.00	0.21534E 08	60.59	73.86	0.60803E 06	0.25567E 05	0.	0.
4.10	0.21534E 08	60.43	74.60	0.60803E 06	0.25567E 05	0.	0.
4.20	0.21534E 08	60.27	75.33	0.60803E 06	0.25567E 05	0.	0.
4.30	0.21534E 08	60.10	76.06	0.60803E 06	0.25567E 05	0.	0.
4.40	0.21534E 08	59.93	76.78	0.60803E 06	0.25567E 05	0.	0.
4.50	0.21534E 08	59.76	77.49	0.60803E 06	0.25567E 05	0.	0.
4.60	0.21534E 08	59.58	78.19	0.60803E 06	0.25567E 05	0.	0.
4.70	0.21534E 08	59.40	78.88	0.60803E 06	0.25567E 05	0.	0.
4.80	0.21534E 08	59.21	79.57	0.60803E 06	0.25567E 05	0.	0.
4.90	0.21534E 08	59.02	80.24	0.60803E 06	0.25567E 05	0.	0.
5.00	0.21534E 08	58.82	80.91	0.60803E 06	0.25567E 05	0.	0.
5.10	0.21534E 08	58.63	81.58	0.60803E 06	0.25567E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 1

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
5.20	.21534E 08	58.42	82.23	0.60803E 06	0.25567E 05	0.	0.
5.30	0.21534E 08	58.22	82.88	0.60803E 06	0.25567E 05	0.	0.
5.40	.21534E 08	58.01	83.52	0.60803E 06	0.25567E 05	0.	0.
5.50	0.21534E 08	57.80	84.15	0.60803E 06	0.25567E 05	0.	0.
5.60	.21534E 08	57.58	84.77	0.60803E 06	0.25567E 05	0.	0.
5.70	0.21534E 08	57.36	85.39	0.60803E 06	0.25567E 05	0.	0.
5.80	.21534E 08	57.14	86.00	0.60803E 06	0.25567E 05	0.	0.
5.90	0.21534E 08	56.92	86.60	0.60803E 06	0.25567E 05	0.	0.
6.00	.21534E 08	56.69	87.19	0.60803E 06	0.25567E 05	0.	0.
6.10	0.21534E 08	56.46	87.78	0.60803E 06	0.25567E 05	0.	0.
6.20	.21534E 08	56.22	88.35	0.60803E 06	0.25567E 05	0.	0.
6.30	0.21534E 08	55.99	88.93	0.60803E 06	0.25567E 05	0.	0.
6.40	.21534E 08	55.75	89.49	0.60803E 06	0.25567E 05	0.	0.
6.50	0.21534E 08	55.50	90.04	0.60803E 06	0.25567E 05	0.	0.
6.60	.21534E 08	55.26	90.59	0.60803E 06	0.25567E 05	0.	0.
6.70	0.21534E 08	55.01	91.14	0.60803E 06	0.25567E 05	0.	0.
6.80	.21534E 08	54.76	91.67	0.60803E 06	0.25567E 05	0.	0.
6.90	0.21534E 08	54.51	92.20	0.60803E 06	0.25567E 05	0.	0.
7.00	.21534E 08	54.25	92.72	0.60803E 06	0.25567E 05	0.	0.
7.10	0.21534E 08	53.99	93.23	0.60803E 06	0.25567E 05	0.	0.
7.20	.21534E 08	53.73	93.74	0.60803E 06	0.25567E 05	0.	0.
7.30	0.21534E 08	53.47	94.24	0.60803E 06	0.25567E 05	0.	0.
7.40	.21534E 08	53.2	94.74	0.60803E 06	0.25567E 05	0.	0.
7.50	0.21534E 08	52.94	95.23	0.60803E 06	0.25567E 05	0.	0.
7.60	.21534E 08	52.67	95.71	0.60803E 06	0.25567E 05	0.	0.
7.70	0.21534E 08	52.40	96.18	0.60803E 06	0.25567E 05	0.	0.
7.80	.21534E 08	52.12	96.65	0.60803E 06	0.25567E 05	0.	0.
7.90	0.21534E 08	51.85	97.12	0.60803E 06	0.25567E 05	0.	0.
8.00	.21534E 08	51.57	97.57	0.60803E 06	0.25567E 05	0.	0.
8.10	.21534E 08	51.29	98.03	0.60803E 06	0.25567E 05	0.	0.
8.20	.21534E 08	51.01	98.47	0.60803E 06	0.25567E 05	0.	0.
8.30	0.21534E 08	50.72	98.91	0.60803E 06	0.25567E 05	0.	0.
8.40	.21534E 08	50.44	99.35	0.60803E 06	0.25567E 05	0.	0.
8.50	0.21534E 08	50.15	99.78	0.60803E 06	0.25567E 05	0.	0.
8.60	.21534E 08	49.86	100.20	0.60803E 06	0.25567E 05	0.	0.
8.70	0.21534E 08	49.57	100.62	0.60803E 06	0.25567E 05	0.	0.
8.80	.21534E 08	49.28	101.03	0.60803E 06	0.25567E 05	0.	0.
8.90	0.21534E 08	48.99	101.44	0.60803E 06	0.25567E 05	0.	0.
9.00	.21534E 08	48.69	101.84	0.60803E 06	0.25567E 05	0.	0.
9.10	0.21534E 08	48.39	102.24	0.60803E 06	0.25567E 05	0.	0.
9.20	.21534E 08	48.09	102.63	0.60803E 06	0.25567E 05	0.	0.
9.30	0.21534E 08	47.79	103.02	0.60803E 06	0.25567E 05	0.	0.
9.40	.21534E 08	47.49	103.40	0.60803E 06	0.25567E 05	0.	0.
9.50	0.21534E 08	47.19	103.78	0.60803E 06	0.25567E 05	0.	0.
9.60	.21534E 08	46.88	104.15	0.60803E 06	0.25567E 05	0.	0.
9.70	0.21534E 08	46.58	104.52	0.60803E 06	0.25567E 05	0.	0.
9.80	.21534E 08	46.27	104.89	0.60803E 06	0.25567E 05	0.	0.
9.90	0.21534E 08	45.96	105.25	0.60803E 06	0.25567E 05	0.	0.
10.00	.21534E 08	45.65	105.61	0.60803E 06	0.25567E 05	0.	0.
10.10	0.21534E 08	45.34	105.96	0.60803E 06	0.25567E 05	0.	0.
10.20	.21534E 08	45.03	106.31	0.60803E 06	0.25567E 05	0.	0.
10.30	0.21534E 08	44.72	106.65	0.60803E 06	0.25567E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 1

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
10.40	0.21534E 08	44.4	106.99	0.60804E 06	0.255674E 05	0.	0.
10.50	0.21534E 08	44.09	107.33	0.60804E 06	0.255674E 05	0.	0.
10.60	0.21534E 08	43.77	107.66	0.60804E 06	0.255674E 05	0.	0.
10.70	0.21534E 08	43.45	107.99	0.60804E 06	0.255674E 05	0.	0.
10.80	0.21534E 08	43.13	108.31	0.60804E 06	0.255674E 05	0.	0.
10.90	0.21534E 08	42.81	108.63	0.60804E 06	0.255674E 05	0.	0.
11.00	0.21534E 08	42.49	108.95	0.60804E 06	0.255674E 05	0.	0.
11.10	0.21534E 08	42.17	109.26	0.60804E 06	0.255674E 05	0.	0.
11.20	0.21534E 08	41.85	109.57	0.60804E 06	0.255674E 05	0.	0.
11.30	0.21534E 08	41.52	109.88	0.60804E 06	0.255674E 05	0.	0.
11.40	0.21534E 08	41.2	110.19	0.60804E 06	0.255674E 05	0.	0.
11.50	0.21534E 08	40.87	110.49	0.60804E 06	0.255674E 05	0.	0.
11.60	0.21534E 08	40.54	110.78	0.60804E 06	0.255674E 05	0.	0.
11.70	0.21534E 08	40.22	111.08	0.60804E 06	0.255674E 05	0.	0.
11.80	0.21534E 08	39.89	111.37	0.60804E 06	0.255674E 05	0.	0.
11.90	0.21534E 08	39.56	111.66	0.60804E 06	0.255674E 05	0.	0.
12.00	0.21534E 08	39.23	111.94	0.60804E 06	0.255674E 05	0.	0.
12.10	0.21534E 08	38.90	112.22	0.60804E 06	0.255674E 05	0.	0.
12.20	0.21534E 08	38.57	112.50	0.60804E 06	0.255674E 05	0.	0.
12.30	0.21534E 08	38.23	112.78	0.60804E 06	0.255674E 05	0.	0.
12.40	0.21534E 08	37.90	113.05	0.60804E 06	0.255674E 05	0.	0.
12.50	0.21534E 08	37.56	113.33	0.60804E 06	0.255674E 05	0.	0.
12.60	0.21534E 08	37.23	113.59	0.60804E 06	0.255674E 05	0.	0.
12.70	0.21534E 08	36.89	113.86	0.60804E 06	0.255674E 05	0.	0.
12.80	0.21534E 08	36.56	114.12	0.60804E 06	0.255674E 05	0.	0.
12.90	0.21534E 08	36.22	114.38	0.60804E 06	0.255674E 05	0.	0.
13.00	0.21534E 08	35.88	114.64	0.60804E 06	0.255674E 05	0.	0.
13.10	0.21534E 08	35.54	114.90	0.60804E 06	0.255674E 05	0.	0.
13.20	0.21534E 08	35.21	115.15	0.60804E 06	0.255674E 05	0.	0.
13.30	0.21534E 08	34.87	115.40	0.60804E 06	0.255674E 05	0.	0.
13.40	0.21534E 08	34.53	115.65	0.60804E 06	0.255674E 05	0.	0.
13.50	0.21534E 08	34.18	115.90	0.60804E 06	0.255674E 05	0.	0.
13.60	0.21534E 08	33.84	116.14	0.60804E 06	0.255674E 05	0.	0.
13.70	0.21534E 08	33.50	116.39	0.60804E 06	0.255674E 05	0.	0.
13.80	0.21534E 08	33.16	116.63	0.60804E 06	0.255674E 05	0.	0.
13.90	0.21534E 08	32.82	116.87	0.60804E 06	0.255674E 05	0.	0.
14.00	0.21534E 08	32.47	117.10	0.60804E 06	0.255674E 05	0.	0.
14.10	0.21534E 08	32.13	117.34	0.60804E 06	0.255674E 05	0.	0.
14.20	0.21534E 08	31.78	117.57	0.60804E 06	0.255674E 05	0.	0.
14.30	0.21534E 08	31.44	117.80	0.60804E 06	0.255674E 05	0.	0.
14.40	0.21534E 08	31.09	118.03	0.60804E 06	0.255674E 05	0.	0.
14.50	0.21534E 08	30.74	118.25	0.60804E 06	0.255674E 05	0.	0.
14.60	0.21534E 08	30.4	118.48	0.60804E 06	0.255674E 05	0.	0.
14.70	0.21534E 08	30.05	118.70	0.60804E 06	0.255674E 05	0.	0.
14.80	0.21534E 08	29.7	118.92	0.60804E 06	0.255674E 05	0.	0.
14.90	0.21534E 08	29.35	119.14	0.60804E 06	0.255674E 05	0.	0.
15.00	0.21534E 08	29.01	119.36	0.60804E 06	0.255674E 05	0.	0.
15.10	0.21534E 08	28.66	119.58	0.60804E 06	0.255674E 05	0.	0.
15.20	0.21534E 08	28.31	119.79	0.60804E 06	0.255674E 05	0.	0.
15.30	0.21534E 08	27.96	120.01	0.60804E 06	0.255674E 05	0.	0.
15.40	0.21534E 08	27.61	120.22	0.60804E 06	0.255674E 05	0.	0.
15.50	0.21534E 08	27.26	120.43	0.60804E 06	0.255674E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 1

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
15.60	0.21534E 08	26.91	120.64	0.60804E 06	0.25567 4E 05	0.	0.
15.70	0.21534E 08	26.55	120.84	0.60804E 06	0.25567 4E 05	0.	0.
15.80	0.21534E 08	26.2[illegible]	121.05	0.60804E 06	0.25567 4E 05	0.	0.
15.90	0.21534E 08	25.85	121.25	0.60804E 06	0.25567 4E 05	0.	0.
16.00	0.21534E 08	25.5[illegible]	121.46	0.60804E 06	0.25567 4E 05	0.	0.
16.10	0.21534E 08	25.14	121.66	0.60804E 06	0.25567 4E 05	0.	0.
16.20	0.21534E 08	24.79	121.86	0.60804E 06	0.25567 4E 05	0.	0.
16.30	0.21534E 08	24.44	122.06	0.60804E 06	0.25567 4E 05	0.	0.
16.40	0.21534E 08	24.08	122.26	0.60804E 06	0.25567 4E 05	0.	0.
16.50	0.21534E 08	23.73	122.45	0.60804E 06	0.25567 4E 05	0.	0.
16.60	0.21534E 08	23.37	122.65	0.60804E 06	0.25567 4E 05	0.	0.
16.70	0.21534E 08	23.02	122.84	0.60804E 06	0.25567 4E 05	0.	0.
16.80	0.21534E 08	22.66	123.04	0.60805E 06	0.25567 4E 05	0.	0.
16.90	0.21534E 08	22.31	123.23	0.60805E 06	0.25567 4E 05	0.	0.
17.00	0.21534E 08	21.95	123.42	0.60805E 06	0.25567 4E 05	0.	0.
17.10	0.21534E 08	21.60	123.61	0.60805E 06	0.25567 4E 05	0.	0.
17.20	0.21534E 08	21.24	123.80	0.60805E 06	0.25567 4E 05	0.	0.
17.30	0.21534E 08	20.88	123.98	0.60805E 06	0.25567 4E 05	0.	0.
17.40	0.21534E 08	20.53	124.17	0.60805E 06	0.25567 4E 05	0.	0.
17.50	0.21534E 08	20.17	124.36	0.60805E 06	0.25567 4E 05	0.	0.
17.60	0.21534E 08	19.81	124.54	0.60805E 06	0.25567 4E 05	0.	0.
17.70	0.21534E 08	19.45	124.73	0.60805E 06	0.25567 4E 05	0.	0.
17.80	0.21534E 08	19.1[illegible]	124.91	0.60805E 06	0.25567 4E 05	0.	0.
17.90	0.21534E 08	18.74	125.09	0.60805E 06	0.25567 4E 05	0.	0.
18.00	0.21534E 08	18.38	125.27	0.60805E 06	0.25567 4E 05	0.	0.
18.10	0.21534E 08	18.02	125.45	0.60805E 06	0.25567 4E 05	0.	0.
18.20	0.21534E 08	17.66	125.63	0.60805E 06	0.25567 4E 05	0.	0.
18.30	0.21534E 08	17.30	125.81	0.60805E 06	0.25567 4E 05	0.	0.
18.40	0.21534E 08	16.95	125.99	0.60805E 06	0.25567 4E 05	0.	0.
18.50	0.21534E 08	16.59	126.17	0.60805E 06	0.25567 4E 05	0.	0.
18.60	0.21534E 08	16.23	126.34	0.60805E 06	0.25567 4E 05	0.	0.
18.70	0.21534E 08	15.87	126.52	0.60805E 06	0.25567 4E 05	0.	0.
18.80	0.21534E 08	15.51	126.69	0.60805E 06	0.25567 4E 05	0.	0.
18.90	0.21534E 08	15.15	126.87	0.60805E 06	0.25567 4E 05	0.	0.
19.00	0.21534E 08	14.79	127.04	0.60805E 06	0.25567 4E 05	0.	0.
19.10	0.21534E 08	14.43	127.21	0.60805E 06	0.25567 4E 05	0.	0.
19.20	0.21534E 08	14.07	127.38	0.60805E 06	0.25567 4E 05	0.	0.
19.30	0.21534E 08	13.70	127.56	0.60805E 06	0.25567 4E 05	0.	0.
19.40	0.21534E 08	13.34	127.73	0.60805E 06	0.25567 4E 05	0.	0.
19.50	0.21534E 08	12.98	127.90	0.60805E 06	0.25567 4E 05	0.	0.
19.60	0.21534E 08	12.62	128.07	0.60805E 06	0.25567 4E 05	0.	0.
19.70	0.21534E 08	12.26	128.24	0.60805E 06	0.25567 4E 05	0.	0.
19.80	0.21534E 08	11.9[illegible]	128.41	0.60805E 06	0.25567 4E 05	0.	0.
19.90	0.21534E 08	11.54	128.57	0.60805E 06	0.25567 4E 05	0.	0.
20.00	0.21534E 08	11.17	128.74	0.60805E 06	0.25567 4E 05	0.	0.

RADAR PARAMETERS , TRAJECTORY NUMBER 1 RADAR SITE 1 35.900 DEG.LAT. 233.333 DEG.LONG.

TIME (MIN)	SL RANGE (NM)	SL RANGE-RATE (FT/S)	ELEVATION (DEG)	EL RATE (DEG/S)	AZIMUTH (DEG)	AZ RATE (DEG/S)	RADIUS (ERV)	INERTIAL PHI (DEG)
11:90	0.761112E 03	-0.174541E 05	1.30	0.5272E-01	291.64	-0.2134E 00	1.029	51.66
12:00	0.743978E 03	-0.170650E 05	1.62	0.5286E-01	290.34	-0.2234E 00	1.029	51.94
12:10	0.727341E 03	-0.166477E 05	1.94	0.5291E-01	288.97	-0.2337E 00	1.029	52.22
12:20	0.711130E 03	-0.162004E 05	2.26	0.5285E-01	287.53	-0.2442E 00	1.029	52.50
12:30	0.695377E 03	-0.157212E 05	2.57	0.5266E-01	286.03	-0.2549E 00	1.029	52.78
12:40	0.680113E 03	-0.152080E 05	2.89	0.5232E-01	284.46	-0.2658E 00	1.029	53.05
12:50	0.665372E 03	-0.146591E 05	3.20	0.5181E-01	282.81	-0.2768E 00	1.029	53.33
12:60	0.651193E 03	-0.140725E 05	3.51	0.5109E-01	281.09	-0.2880E 00	1.029	53.59
12:70	0.637611E 03	-0.134464E 05	3.81	0.5014E-01	279.30	-0.3059E 00	1.029	53.86
12:80	0.624667E 03	-0.127795E 05	4.11	0.4893E-01	277.42	-0.3191E 00	1.029	54.12
12:90	0.612402E 03	-0.120714E 05	4.40	0.4744E-01	275.47	-0.3329E 00	1.029	54.38
13:00	0.600858E 03	-0.113181E 05	4.68	0.4562E-01	273.43	-0.3856E 00	1.029	54.64
13:10	0.590078E 03	-0.105222E 05	4.95	0.4346E-01	271.32	-0.3587E 00	1.029	54.90
13:20	0.580105E 03	-0.968279E 04	5.20	0.4094E-01	269.13	-0.3715E 00	1.029	55.15
13:30	0.570981E 03	-0.880046E 04	5.44	0.3803E-01	266.86	-0.3839E 00	1.029	55.40
13:40	0.562749E 03	-0.787661E 04	5.66	0.3473E-01	264.52	-0.3956E 00	1.029	55.65
13:50	0.555448E 03	-0.691340E 04	5.85	0.3105E-01	262.12	-0.4068E 00	1.029	55.90
13:60	0.549116E 03	-0.591380E 04	6.03	0.2700E-01	259.65	-0.4169E 00	1.029	56.14
13:70	0.543787E 03	-0.488164E 04	6.18	0.2260E-01	257.13	-0.4246E 00	1.029	56.39
13:80	0.539491E 03	-0.382156E 04	6.30	0.1789E-01	254.56	-0.4317E 00	1.029	56.63
13:90	0.536252E 03	-0.273892E 04	6.39	0.1294E-01	251.95	-0.4379E 00	1.029	56.87
14:00	0.534090E 03	-0.163975E 04	6.45	0.7791E-02	249.32	-0.4408E 00	1.029	57.10
14:10	0.533019E 03	-0.530549E 03	6.48	0.2528E-02	246.66	-0.4426E 00	1.029	57.34
14:20	0.533044E 03	0.581870E 03	6.48	-0.2772E-02	244.01	-0.4420E 00	1.029	57.57
14:30	0.534166E 03	0.169061E 04	6.45	-0.8030E-02	241.36	-0.4406E 00	1.029	57.80
14:40	0.536378E 03	0.278886E 04	6.39	-0.1317E-01	238.72	-0.4369E 00	1.029	58.03
14:50	0.539665E 03	0.387016E 04	6.29	-0.1811E-01	236.12	-0.4310E 00	1.029	58.25
14:60	0.544009E 03	0.492851E 04	6.17	-0.2280E-01	233.55	-0.4243E 00	1.029	58.48
14:70	0.549383E 03	0.595859E 04	6.02	-0.2718E-01	231.03	-0.4158E 00	1.029	58.70
14:80	0.555758E 03	0.695580E 04	5.84	-0.3122E-01	228.56	-0.4060E 00	1.029	58.92
14:90	0.563099E 03	0.791638E 04	5.65	-0.3488E-01	226.16	-0.3954E 00	1.029	59.14
15:00	0.571369E 03	0.883740E 04	5.43	-0.3815E-01	223.82	-0.3836E 00	1.029	59.36
15:10	0.580528E 03	0.971675E 04	5.19	-0.4104E-01	221.56	-0.3714E 00	1.029	59.58
15:20	0.590533E 03	0.105531E 05	4.93	-0.4354E-01	219.37	-0.3583E 00	1.029	59.79
15:30	0.601342E 03	0.113458E 05	4.67	-0.4568E-01	217.26	-0.3452E 00	1.029	60.01
15:40	0.612912E 03	0.120949E 05	4.39	-0.4748E-01	215.23	-0.3319E 00	1.029	60.22
15:50	0.625199E 03	0.128019E 05	4.10	-0.4896E-01	213.28	-0.3187E 00	1.029	60.43
15:60	0.638163E 03	0.134647E 05	3.80	-0.5016E-01	211.41	-0.3056E 00	1.029	60.64
15:70	0.651761E 03	0.140876E 05	3.50	-0.5109E-01	209.61	-0.2927E 00	1.029	60.84
15:80	0.665954E 03	0.146712E 05	3.19	-0.5179E-01	207.89	-0.2804E 00	1.029	61.05
15:90	0.680705E 03	0.152172E 05	2.88	-0.5230E-01	206.25	-0.2679E 00	1.029	61.25
16:00	0.695977E 03	0.157275E 05	2.56	-0.5263E-01	204.68	-0.2560E 00	1.029	61.46
16:10	0.711735E 03	0.162040E 05	2.24	-0.5281E-01	203.18	-0.2446E 00	1.029	61.66
16:20	0.727948E 03	0.166486E 05	1.93	-0.5286E-01	201.74	-0.2337E 00	1.029	61.86
16:30	0.744584E 03	0.170633E 05	1.61	-0.5281E-01	200.37	-0.2232E 00	1.029	62.06
16:40	0.761616E 03	0.174499E 05	1.29	-0.5267E-01	199.06	-0.2132E 00	1.029	62.26

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 4

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
0.	.21534E 08	62.7	40.35	0.60803E 06	0.255674E 05	0.	0.
0.10	0.21534E 08	62.76	41.21	0.60806E 06	0.255674E 05	0.	0.
0.20	.21534E 08	62.8	42.07	0.60809E 06	0.255674E 05	0.	0.
0.30	0.21534E 08	62.85	42.93	0.60812E 06	0.255673E 05	0.	0.
0.40	.21534E 08	62.89	43.80	0.60815E 06	0.255673E 05	0.	0.
0.50	0.21534E 08	62.92	44.67	0.60818E 06	0.255672E 05	0.	0.
0.60	.21534E 08	62.95	45.54	0.60821E 06	0.255672E 05	0.	0.
0.70	0.21534E 08	62.97	46.41	0.60824E 06	0.255672E 05	0.	0.
0.80	.21534E 08	62.99	47.28	0.60827E 06	0.255671E 05	0.	0.
0.90	0.21534E 08	63.00	48.15	0.60830E 06	0.255671E 05	0.	0.
1.00	.21534E 08	63.01	49.03	0.60833E 06	0.255671E 05	0.	0.
1.10	0.21534E 08	63.00	49.90	0.60836E 06	0.255670E 05	0.	0.
1.20	.21534E 08	62.99	50.77	0.60839E 06	0.255670E 05	0.	0.
1.30	0.21534E 08	62.98	51.65	0.60842E 06	0.255670E 05	0.	0.
1.40	.21534E 08	62.96	52.52	0.60845E 06	0.255669E 05	0.	0.
1.50	0.21534E 08	62.94	53.39	0.60848E 06	0.255669E 05	0.	0.
1.60	.21534E 08	62.91	54.26	0.60851E 06	0.255669E 05	0.	0.
1.70	0.21534E 08	62.87	55.13	0.60854E 06	0.255668E 05	0.	0.
1.80	.21534E 08	62.83	55.99	0.60857E 06	0.255668E 05	0.	0.
1.90	0.21534E 08	62.78	56.85	0.60860E 06	0.255667E 05	0.	0.
2.00	.21534E 08	62.73	57.71	0.60863E 06	0.255667E 05	0.	0.
2.10	0.21534E 08	62.67	58.57	0.60866E 06	0.255667E 05	0.	0.
2.20	.21534E 08	62.61	59.42	0.60869E 06	0.255666E 05	0.	0.
2.30	0.21534E 08	62.54	60.27	0.60872E 06	0.255666E 05	0.	0.
2.40	.21534E 08	62.47	61.11	0.60874E 06	0.255666E 05	0.	0.
2.50	0.21534E 08	62.39	61.95	0.60877E 06	0.255665E 05	0.	0.
2.60	.21534E 08	62.3	62.79	0.60880E 06	0.255665E 05	0.	0.
2.70	0.21534E 08	62.21	63.62	0.60883E 06	0.255665E 05	0.	0.
2.80	.21535E 08	62.12	64.45	0.60886E 06	0.255664E 05	0.	0.
2.90	0.21535E 08	62.02	65.26	0.60889E 06	0.255664E 05	0.	0.
3.00	.21535E 08	61.9	66.08	0.60892E 06	0.255664E 05	0.	0.
3.10	0.21535E 08	61.80	66.89	0.60895E 06	0.255663E 05	0.	0.
3.20	.21535E 08	61.69	67.69	0.60898E 06	0.255663E 05	0.	0.
3.30	0.21535E 08	61.57	68.48	0.60901E 06	0.255663E 05	0.	0.
3.40	.21535E 08	61.44	69.27	0.60904E 06	0.255662E 05	0.	0.
3.50	0.21535E 08	61.31	70.05	0.60907E 06	0.255662E 05	0.	0.
3.60	.21535E 08	61.17	70.83	0.60910E 06	0.255662E 05	0.	0.
3.70	0.21535E 08	61.04	71.60	0.60913E 06	0.255661E 05	0.	0.
3.80	.21535E 08	60.89	72.36	0.60916E 06	0.255661E 05	0.	0.
3.90	0.21535E 08	60.74	73.11	0.60918E 06	0.255660E 05	0.	0.
4.00	.21535E 08	60.59	73.86	0.60921E 06	0.255660E 05	0.	0.
4.10	0.21535E 08	60.43	74.60	0.60924E 06	0.255660E 05	0.	0.
4.20	.21535E 08	60.27	75.33	0.60927E 06	0.255659E 05	0.	0.
4.30	0.21535E 08	60.10	76.06	0.60930E 06	0.255659E 05	0.	0.
4.40	.21535E 08	59.93	76.77	0.60933E 06	0.255659E 05	0.	0.
4.50	.21535E 08	59.76	77.48	0.60936E 06	0.255658E 05	0.	0.
4.60	.21535E 08	59.58	78.18	0.60938E 06	0.255658E 05	0.	0.
4.70	.21535E 08	59.40	78.88	0.60941E 06	0.255658E 05	0.	0.
4.80	.21535E 8	59.21	79.56	0.60944E 06	0.255657E 05	0.	0.
4.90	.21535E 08	59.02	80.24	0.60947E 06	0.255657E 05	0.	0.
5.00	.21535E 8	58.82	80.91	0.60950E 06	0.255657E 05	0.	0.
5.10	.21535E 08	58.63	81.57	0.60953E 06	0.255656E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 4

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
5.20	0.21535E 08	58.42	82.23	0.60955E 06	0.25565E 05	0.	0.
5.30	0.21535E 08	58.22	82.88	0.60958E 06	0.25565E 05	0.	0.
5.40	0.21535E 08	58.01	83.52	0.60961E 06	0.25565E 05	0.	0.
5.50	0.21535E 08	57.80	84.15	0.60964E 06	0.25565E 05	0.	0.
5.60	0.21535E 08	57.58	84.77	0.60967E 06	0.25565E 05	0.	0.
5.70	0.21535E 08	57.37	85.39	0.60969E 06	0.25565E 05	0.	0.
5.80	0.21535E 08	57.14	85.99	0.60972E 06	0.25565E 05	0.	0.
5.90	0.21535E 08	56.92	86.59	0.60975E 06	0.25565E 05	0.	0.
6.00	0.21535E 08	56.69	87.19	0.60978E 06	0.25565E 05	0.	0.
6.10	0.21535E 08	56.46	87.77	0.60980E 06	0.25565E 05	0.	0.
6.20	0.21535E 08	56.22	88.35	0.60983E 06	0.25565E 05	0.	0.
6.30	0.21535E 08	55.99	88.92	0.60986E 06	0.25565E 05	0.	0.
6.40	0.21536E 08	55.75	89.49	0.60988E 06	0.25565E 05	0.	0.
6.50	0.21536E 08	55.51	90.04	0.60991E 06	0.25565E 05	0.	0.
6.60	0.21536E 08	55.26	90.59	0.60994E 06	0.25565E 05	0.	0.
6.70	0.21536E 08	55.01	91.13	0.60997E 06	0.25565E 05	0.	0.
6.80	0.21536E 08	54.76	91.67	0.60999E 06	0.25565E 05	0.	0.
6.90	0.21536E 08	54.51	92.20	0.61002E 06	0.25565E 05	0.	0.
7.00	0.21536E 08	54.25	92.72	0.61005E 06	0.25565E 05	0.	0.
7.10	0.21536E 08	53.99	93.23	0.61007E 06	0.25565E 05	0.	0.
7.20	0.21536E 08	53.73	93.74	0.61010E 06	0.25565E 05	0.	0.
7.30	0.21536E 08	53.47	94.24	0.61012E 06	0.25564E 05	0.	0.
7.40	0.21536E 08	53.21	94.73	0.61015E 06	0.25564E 05	0.	0.
7.50	0.21536E 08	52.94	95.22	0.61018E 06	0.25564E 05	0.	0.
7.60	0.21536E 08	52.67	95.70	0.61020E 06	0.25564E 05	0.	0.
7.70	0.21536E 08	52.40	96.18	0.61023E 06	0.25564E 05	0.	0.
7.80	0.21536E 08	52.12	96.65	0.61025E 06	0.25564E 05	0.	0.
7.90	0.21536E 08	51.85	97.11	0.61028E 06	0.25564E 05	0.	0.
8.00	0.21536E 08	51.57	97.57	0.61030E 06	0.25564E 05	0.	0.
8.10	0.21536E 08	51.29	98.02	0.61033E 06	0.25564E 05	0.	0.
8.20	0.21536E 08	51.01	98.47	0.61035E 06	0.25564E 05	0.	0.
8.30	0.21536E 08	50.73	98.91	0.61038E 06	0.25564E 05	0.	0.
8.40	0.21536E 08	50.44	99.34	0.61040E 06	0.25564E 05	0.	0.
8.50	0.21536E 08	50.15	99.77	0.61043E 06	0.25564E 05	0.	0.
8.60	0.21536E 08	49.86	100.20	0.61045E 06	0.25564E 05	0.	0.
8.70	0.21536E 08	49.57	100.61	0.61048E 06	0.25564E 05	0.	0.
8.80	0.21536E 08	49.28	101.03	0.61050E 06	0.25564E 05	0.	0.
8.90	0.21536E 08	48.99	101.43	0.61053E 06	0.25564E 05	0.	0.
9.00	0.21536E 08	48.69	101.84	0.61055E 06	0.25564E 05	0.	0.
9.10	0.21536E 08	48.40	102.23	0.61058E 06	0.25564E 05	0.	0.
9.20	0.21536E 08	48.10	102.63	0.61060E 06	0.25564E 05	0.	0.
9.30	0.21536E 08	47.80	103.01	0.61062E 06	0.25564E 05	0.	0.
9.40	0.21536E 08	47.50	103.40	0.61065E 06	0.25564E 05	0.	0.
9.50	0.21536E 08	47.19	103.78	0.61067E 06	0.25564E 05	0.	0.
9.60	0.21536E 08	46.89	104.15	0.61069E 06	0.25564E 05	0.	0.
9.70	0.21536E 08	46.58	104.52	0.61072E 06	0.25564E 05	0.	0.
9.80	0.21536E 08	46.28	104.88	0.61074E 06	0.25564E 05	0.	0.
9.90	0.21536E 08	45.97	105.24	0.61076E 06	0.25564E 05	0.	0.
10.00	0.21536E 08	45.66	105.60	0.61079E 06	0.25564E 05	0.	0.
10.10	0.21536E 08	45.35	105.95	0.61081E 06	0.25564E 05	0.	0.
10.20	0.21536E 08	45.03	106.30	0.61083E 06	0.25564E 05	0.	0.
10.30	0.21536E 08	44.72	106.65	0.61086E 06	0.25564E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 4

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
10.40	0.21537E 08	44.41	106.98	0.61088E 06	0.25564OE 05	0.	0.
10.50	0.21537E 08	44.09	107.32	0.61090E 06	0.25564OE 05	0.	0.
10.60	0.21537E 08	43.77	107.65	0.61092E 06	0.25564OE 05	0.	0.
10.70	0.21537E 08	43.46	107.98	0.61094E 06	0.25564OE 05	0.	0.
10.80	0.21537E 08	43.14	108.31	0.61097E 06	0.255639E 05	0.	0.
10.90	0.21537E 08	42.82	108.63	0.61099E 06	0.255639E 05	0.	0.
11.00	0.21537E 08	42.5	108.94	0.61101E 06	0.255639E 05	0.	0.
11.10	0.21537E 08	42.17	109.26	0.61103E 06	0.255639E 05	0.	0.
11.20	0.21537E 08	41.85	109.57	0.61105E 06	0.255638E 05	0.	0.
11.30	0.21537E 08	41.53	109.88	0.61107E 06	0.255638E 05	0.	0.
11.40	0.21537E 08	41.2	110.18	0.61109E 06	0.255638E 05	0.	0.
11.50	0.21537E 08	40.88	110.48	0.61111E 06	0.255638E 05	0.	0.
11.60	0.21537E 08	40.55	110.78	0.61113E 06	0.255637E 05	0.	0.
11.70	0.21537E 08	40.22	111.07	0.61115E 06	0.255637E 05	0.	0.
11.80	0.21537E 08	39.89	111.36	0.61117E 06	0.255637E 05	0.	0.
11.90	0.21537E 08	39.56	111.65	0.61119E 06	0.255637E 05	0.	0.
12.00	0.21537E 08	39.23	111.94	0.61121E 06	0.255636E 05	0.	0.
12.10	0.21537E 08	38.90	112.22	0.61123E 06	0.255636E 05	0.	0.
12.20	0.21537E 08	38.57	112.50	0.61125E 06	0.255636E 05	0.	0.
12.30	0.21537E 08	38.24	112.78	0.61127E 06	0.255636E 05	0.	0.
12.40	0.21537E 08	37.91	113.05	0.61129E 06	0.255635E 05	0.	0.
12.50	0.21537E 08	37.57	113.32	0.61131E 06	0.255635E 05	0.	0.
12.60	0.21537E 08	37.24	113.59	0.61133E 06	0.255635E 05	0.	0.
12.70	0.21537E 08	36.90	113.85	0.61135E 06	0.255635E 05	0.	0.
12.80	0.21537E 08	36.56	114.12	0.61137E 06	0.255635E 05	0.	0.
12.90	0.21537E 08	36.23	114.38	0.61139E 06	0.255634E 05	0.	0.
13.00	0.21537E 08	35.89	114.64	0.61140E 06	0.255634E 05	0.	0.
13.10	0.21537E 08	35.55	114.89	0.61142E 06	0.255634E 05	0.	0.
13.20	0.21537E 08	35.21	115.15	0.61144E 06	0.255634E 05	0.	0.
13.30	0.21537E 08	34.87	115.40	0.61146E 06	0.255633E 05	0.	0.
13.40	0.21537E 08	34.53	115.65	0.61148E 06	0.255633E 05	0.	0.
13.50	0.21537E 08	34.19	115.89	0.61149E 06	0.255633E 05	0.	0.
13.60	0.21537E 08	33.85	116.14	0.61151E 06	0.255633E 05	0.	0.
13.70	0.21537E 08	33.51	116.38	0.61153E 06	0.255633E 05	0.	0.
13.80	0.21537E 08	33.17	116.62	0.61154E 06	0.255632E 05	0.	0.
13.90	0.21537E 08	32.82	116.86	0.61156E 06	0.255632E 05	0.	0.
14.00	0.21537E 08	32.48	117.10	0.61158E 06	0.255632E 05	0.	0.
14.10	0.21537E 08	32.14	117.33	0.61159E 06	0.255632E 05	0.	0.
14.20	0.21537E 08	31.79	117.56	0.61161E 06	0.255632E 05	0.	0.
14.30	0.21537E 08	31.45	117.79	0.61163E 06	0.255631E 05	0.	0.
14.40	0.21537E 08	31.1	118.02	0.61164E 06	0.255631E 05	0.	0.
14.50	0.21537E 08	30.75	118.25	0.61166E 06	0.255631E 05	0.	0.
14.60	0.21537E 08	30.41	118.47	0.61167E 06	0.255631E 05	0.	0.
14.70	0.21537E 08	30.06	118.70	0.61169E 06	0.255631E 05	0.	0.
14.80	0.21537E 08	29.71	118.92	0.61170E 06	0.255631E 05	0.	0.
14.90	0.21537E 08	29.36	119.14	0.61172E 06	0.255630E 05	0.	0.
15.00	0.21537E 08	29.02	119.35	0.61173E 06	0.255630E 05	0.	0.
15.10	0.21537E 08	28.67	119.57	0.61175E 06	0.255630E 05	0.	0.
15.20	0.21537E 08	28.32	119.79	0.61176E 06	0.255630E 05	0.	0.
15.30	0.21537E 08	27.97	120.00	0.61178E 06	0.255630E 05	0.	0.
15.40	0.21537E 08	27.62	120.21	0.61179E 06	0.255630E 05	0.	0.
15.50	0.21537E 08	27.27	120.42	0.61180E 06	0.255629E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 4

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
15.60	0.21537E 08	26.92	120.63	0.61182E 06	0.25562 9E 05	0.	0.
15.70	0.21537E 08	26.56	120.84	0.61183E 06	0.25562 9E 05	0.	0.
15.80	0.21537E 08	26.21	121.04	0.61184E 06	0.25562 9E 05	0.	0.
15.90	0.21537E 08	25.86	121.25	0.61186E 06	0.25562 9E 05	0.	0.
16.00	0.21538E 08	25.51	121.45	0.61187E 06	0.25562 9E 05	0.	0.
16.10	0.21538E 08	25.16	121.65	0.61188E 06	0.25562 8E 05	0.	0.
16.20	0.21538E 08	24.81	121.85	0.61190E 06	0.25562 8E 05	0.	0.
16.30	0.21538E 08	24.45	122.05	0.61191E 06	0.25562 8E 05	0.	0.
16.40	0.21538E 08	24.11	122.25	0.61192E 06	0.25562 8E 05	0.	0.
16.50	0.21538E 08	23.74	122.45	0.61193E 06	0.25562 8E 05	0.	0.
16.60	0.21538E 08	23.39	122.64	0.61194E 06	0.25562 8E 05	0.	0.
16.70	0.21538E 08	23.03	122.84	0.61195E 06	0.25562 8E 05	0.	0.
16.80	0.21538E 08	22.68	123.03	0.61197E 06	0.25562 7E 05	0.	0.
16.90	0.21538E 08	22.32	123.22	0.61198E 06	0.25562 7E 05	0.	0.
17.00	0.21538E 08	21.97	123.41	0.61199E 06	0.25562 7E 05	0.	0.
17.10	0.21538E 08	21.61	123.60	0.61200E 06	0.25562 7E 05	0.	0.
17.20	0.21538E 08	21.25	123.79	0.61201E 06	0.25562 7E 05	0.	0.
17.30	0.21538E 08	20.90	123.98	0.61202E 06	0.25562 7E 05	0.	0.
17.40	0.21538E 08	20.54	124.16	0.61203E 06	0.25562 7E 05	0.	0.
17.50	0.21538E 08	20.18	124.35	0.61204E 06	0.25562 7E 05	0.	0.
17.60	0.21538E 08	19.83	124.53	0.61205E 06	0.25562 6E 05	0.	0.
17.70	0.21538E 08	19.47	124.72	0.61206E 06	0.25562 6E 05	0.	0.
17.80	0.21538E 08	19.11	124.90	0.61207E 06	0.25562 6E 05	0.	0.
17.90	0.21538E 08	18.75	125.08	0.61208E 06	0.25562 6E 05	0.	0.
18.00	0.21538E 08	18.39	125.26	0.61208E 06	0.25562 6E 05	0.	0.
18.10	0.21538E 08	18.04	125.44	0.61209E 06	0.25562 6E 05	0.	0.
18.20	0.21538E 08	17.68	125.62	0.61210E 06	0.25562 6E 05	0.	0.
18.30	0.21538E 08	17.32	125.80	0.61211E 06	0.25562 6E 05	0.	0.
18.40	0.21538E 08	16.96	125.98	0.61212E 06	0.25562 6E 05	0.	0.
18.50	0.21538E 08	16.60	126.16	0.61213E 06	0.25562 6E 05	0.	0.
18.60	0.21538E 08	16.24	126.33	0.61213E 06	0.25562 5E 05	0.	0.
18.70	0.21538E 08	15.88	126.51	0.61214E 06	0.25562 5E 05	0.	0.
18.80	0.21538E 08	15.52	126.68	0.61215E 06	0.25562 5E 05	0.	0.
18.90	0.21538E 08	15.16	126.86	0.61215E 06	0.25562 5E 05	0.	0.
19.00	0.21538E 08	14.8	127.03	0.61216E 06	0.25562 5E 05	0.	0.
19.10	0.21538E 08	14.44	127.20	0.61217E 06	0.25562 5E 05	0.	0.
19.20	0.21538E 08	14.08	127.38	0.61217E 06	0.25562 5E 05	0.	0.
19.30	0.21538E 08	13.72	127.55	0.61218E 06	0.25562 5E 05	0.	0.
19.40	0.21538E 08	13.36	127.72	0.61219E 06	0.25562 5E 05	0.	0.
19.50	0.21538E 08	13.00	127.89	0.61219E 06	0.25562 5E 05	0.	0.
19.60	0.21538E 08	12.64	128.06	0.61220E 06	0.25562 5E 05	0.	0.
19.70	0.21538E 08	12.28	128.23	0.61220E 06	0.25562 5E 05	0.	0.
19.80	0.21538E 08	11.91	128.40	0.61221E 06	0.25562 5E 05	0.	0.
19.90	0.21538E 08	11.55	128.56	0.61221E 06	0.25562 5E 05	0.	0.
20.00	0.21538E 08	11.19	128.73	0.61222E 06	0.25562 4E 05	0.	0.

RADAR PARAMETERS , TRAJECTORY NUMBER 4 RADAR SITE 1 35.900 DEG,LAT. 233.333 DEG,LONG,

TIME (MIN)	SL RANGE (NM)	SL RANGE-RATE (FT/S)	ELEVATION (DEG)	EL RATE (DEG/S)	AZIMUTH (DEG)	AZ RATE (DEG/S)	RADIUS (ERV)	INERTIAL PHI (DEG)
11.80	0.778882E 03	-0.178166E 05	1.02	0.5267E-01	292.92	-0.2033E 00	1.029	51.36
11.90	0.761476E 03	-0.174544E 05	1.34	0.5288E-01	291.67	-0.2128E 00	1.029	51.65
12.00	0.744441E 03	-0.170659E 05	1.65	0.5303E-01	290.36	-0.2229E 00	1.029	51.94
12.10	0.727803E 03	-0.166493E 05	1.97	0.5308E-01	288.99	-0.2330E 00	1.029	52.22
12.20	0.711591E 03	-0.162028E 05	2.29	0.5303E-01	287.56	-0.2440E 00	1.029	52.50
12.30	0.695834E 03	-0.157244E 05	2.61	0.5285E-01	286.06	-0.2550E 00	1.029	52.78
12.40	0.680567E 03	-0.152122E 05	2.92	0.5251E-01	284.49	-0.2677E 00	1.029	53.05
12.50	0.665822E 03	-0.146642E 05	3.24	0.5200E-01	282.85	-0.2800E 00	1.029	53.32
12.60	0.651636E 03	-0.140787E 05	3.55	0.5129E-01	281.13	-0.2926E 00	1.029	53.59
12.70	0.638048E 03	-0.134538E 05	3.85	0.5035E-01	279.33	-0.3055E 00	1.029	53.85
12.80	0.625096E 03	-0.127881E 05	4.15	0.4915E-01	277.46	-0.3187E 00	1.029	54.12
12.90	0.612822E 03	-0.120803E 05	4.44	0.4766E-01	275.51	-0.3319E 00	1.029	54.38
13.00	0.601268E 03	-0.113295E 05	4.72	0.4585E-01	273.48	-0.3452E 00	1.029	54.64
13.10	0.590476E 03	-0.105351E 05	4.99	0.4369E-01	271.37	-0.3583E 00	1.029	54.89
13.20	0.580489E 03	-0.969719E 04	5.25	0.4117E-01	269.18	-0.3711E 00	1.029	55.15
13.30	0.571351E 03	-0.881643E 04	5.49	0.3827E-01	266.92	-0.3835E 00	1.029	55.40
13.40	0.563102E 03	-0.789418E 04	5.71	0.3497E-01	264.58	-0.3952E 00	1.029	55.65
13.50	0.555783E 03	-0.693258E 04	5.90	0.3129E-01	262.18	-0.4060E 00	1.029	55.89
13.60	0.549431E 03	-0.593457E 04	6.08	0.2723E-01	259.71	-0.4158E 00	1.029	56.14
13.70	0.544081E 03	-0.490396E 04	6.23	0.2283E-01	257.19	-0.4243E 00	1.029	56.38
13.80	0.539761E 03	-0.384534E 04	6.35	0.1812E-01	254.62	-0.4313E 00	1.029	56.62
13.90	0.536499E 03	-0.276409E 04	6.45	0.1315E-01	252.02	-0.4368E 00	1.029	56.86
14.00	0.534311E 03	-0.166617E 04	6.51	0.7995E-02	249.38	-0.4405E 00	1.029	57.10
14.10	0.533213E 03	-0.558085E 03	6.54	0.2719E-02	246.73	-0.4426E 00	1.029	57.33
14.20	0.533211E 03	0.553386E 03	6.54	-0.2598E-02	244.08	-0.4426E 00	1.029	57.56
14.30	0.534304E 03	0.166135E 04	6.51	-0.7875E-02	241.43	-0.4405E 00	1.029	57.79
14.40	0.536487E 03	0.275912E 04	6.45	-0.1303E-01	238.80	-0.4368E 00	1.029	58.02
14.50	0.539744E 03	0.383993E 04	6.36	-0.1800E-01	236.19	-0.4310E 00	1.029	58.25
14.60	0.544058E 03	0.489877E 04	6.23	-0.2271E-01	233.62	-0.4240E 00	1.029	58.47
14.70	0.549402E 03	0.592812E 04	6.08	-0.2712E-01	231.10	-0.4159E 00	1.029	58.70
14.80	0.555747E 03	0.692546E 04	5.91	-0.3117E-01	228.63	-0.4061E 00	1.029	58.92
14.90	0.563059E 03	0.788633E 04	5.71	-0.3486E-01	226.23	-0.3952E 00	1.029	59.14
15.00	0.571300E 03	0.880776E 04	5.49	-0.3815E-01	223.89	-0.3836E 00	1.029	59.35
15.10	0.580429E 03	0.968763E 04	5.25	-0.4106E-01	221.63	-0.3718E 00	1.029	59.57
15.20	0.590406E 03	0.105246E 05	5.00	-0.4358E-01	219.44	-0.3585E 00	1.029	59.79
15.30	0.601187E 03	0.113180E 05	4.73	-0.4574E-01	217.33	-0.3450E 00	1.029	60.00
15.40	0.612731E 03	0.120678E 05	4.45	-0.4755E-01	215.29	-0.3322E 00	1.029	60.21
15.50	0.624991E 03	0.127746E 05	4.16	-0.4905E-01	213.34	-0.3190E 00	1.029	60.42
15.60	0.637929E 03	0.134392E 05	3.86	-0.5025E-01	211.46	-0.3059E 00	1.029	60.63
15.70	0.651502E 03	0.140629E 05	3.56	-0.5120E-01	209.67	-0.2930E 00	1.029	60.84
15.80	0.665672E 03	0.146474E 05	3.25	-0.5191E-01	207.95	-0.2808E 00	1.029	61.04
15.90	0.680399E 03	0.151942E 05	2.94	-0.5242E-01	206.30	-0.2681E 00	1.029	61.25
16.00	0.695648E 03	0.157053E 05	2.62	-0.5275E-01	204.73	-0.2563E 00	1.029	61.45
16.10	0.711385E 03	0.161825E 05	2.30	-0.5294E-01	203.23	-0.2449E 00	1.029	61.65
16.20	0.727577E 03	0.166279E 05	1.99	-0.5299E-01	201.79	-0.2339E 00	1.029	61.85
16.30	0.744194E 03	0.170433E 05	1.67	-0.5294E-01	200.42	-0.2238E 00	1.029	62.05
16.40	0.761216E 03	0.174316E 05	1.35	-0.5280E-01	199.11	-0.2138E 00	1.029	62.25
16.50	0.778587E 03	0.177916E 05	1.03	-0.5259E-01	197.86	-0.2039E 00	1.029	62.45

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 5

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
0.	0.21534E 08	62.77	40.35	0.60803E 06	0.25565E 05	0.	0.
0.10	0.21534E 08	62.76	41.21	0.60803E 06	0.25565E 05	0.	0.
0.20	0.21534E 08	62.81	42.07	0.60803E 06	0.25565E 05	0.	0.
0.30	0.21534E 08	62.85	42.93	0.60803E 06	0.25565E 05	0.	0.
0.40	0.21534E 08	62.89	43.80	0.60803E 06	0.25565E 05	0.	0.
0.50	0.21534E 08	62.92	44.67	0.60803E 06	0.25565E 05	0.	0.
0.60	0.21534E 08	62.95	45.54	0.60802E 06	0.25565E 05	0.	0.
0.70	0.21534E 08	62.97	46.41	0.60802E 06	0.25566E 05	0.	0.
0.80	0.21534E 08	62.99	47.28	0.60802E 06	0.25565E 05	0.	0.
0.90	0.21534E 08	63.00	48.15	0.60802E 06	0.25565E 05	0.	0.
1.00	0.21534E 08	63.01	49.03	0.60802E 06	0.25565E 05	0.	0.
1.10	0.21534E 08	63.00	49.90	0.60802E 06	0.25565E 05	0.	0.
1.20	0.21534E 08	62.99	50.77	0.60801E 06	0.25565E 05	0.	0.
1.30	0.21534E 08	62.98	51.65	0.60801E 06	0.25565E 05	0.	0.
1.40	0.21534E 08	62.96	52.52	0.60801E 06	0.25565E 05	0.	0.
1.50	0.21534E 08	62.94	53.39	0.60801E 06	0.25565E 05	0.	0.
1.60	0.21534E 08	62.91	54.26	0.60800E 06	0.25565E 05	0.	0.
1.70	0.21534E 08	62.87	55.13	0.60800E 06	0.25565E 05	0.	0.
1.80	0.21534E 08	62.83	55.99	0.60800E 06	0.25565E 05	0.	0.
1.90	0.21534E 08	62.78	56.85	0.60799E 06	0.25565E 05	0.	0.
2.00	0.21534E 08	62.73	57.71	0.60799E 06	0.25565E 05	0.	0.
2.10	0.21534E 08	62.67	58.57	0.60798E 06	0.25565E 05	0.	0.
2.20	0.21534E 08	62.61	59.42	0.60798E 06	0.25565E 05	0.	0.
2.30	0.21534E 08	62.54	60.27	0.60798E 06	0.25565E 05	0.	0.
2.40	0.21534E 08	62.47	61.11	0.60797E 06	0.25565E 05	0.	0.
2.50	0.21534E 08	62.39	61.95	0.60797E 06	0.25565E 05	0.	0.
2.60	0.21534E 08	62.31	62.79	0.60796E 06	0.25565E 05	0.	0.
2.70	0.21534E 08	62.21	63.62	0.60796E 06	0.25565E 05	0.	0.
2.80	0.21534E 08	62.12	64.44	0.60795E 06	0.25565E 05	0.	0.
2.90	0.21534E 08	62.02	65.26	0.60795E 06	0.25565E 05	0.	0.
3.00	0.21534E 08	61.91	66.08	0.60794E 06	0.25565E 05	0.	0.
3.10	0.21534E 08	61.80	66.88	0.60793E 06	0.25565E 05	0.	0.
3.20	0.21534E 08	61.69	67.69	0.60793E 06	0.25565E 05	0.	0.
3.30	0.21534E 08	61.57	68.48	0.60792E 06	0.25565E 05	0.	0.
3.40	0.21534E 08	61.44	69.27	0.60792E 06	0.25565E 05	0.	0.
3.50	0.21534E 08	61.31	70.05	0.60791E 06	0.25565E 05	0.	0.
3.60	0.21534E 08	61.18	70.83	0.60790E 06	0.25565E 05	0.	0.
3.70	0.21534E 08	61.04	71.60	0.60789E 06	0.25565E 05	0.	0.
3.80	0.21534E 08	60.89	72.36	0.60789E 06	0.25565E 05	0.	0.
3.90	0.21534E 08	60.74	73.11	0.60788E 06	0.25565E 05	0.	0.
4.00	0.21534E 08	60.59	73.86	0.60787E 06	0.25565E 05	0.	0.
4.10	0.21534E 08	60.43	74.60	0.60786E 06	0.25565E 05	0.	0.
4.20	0.21533E 08	60.27	75.33	0.60786E 06	0.25565E 05	0.	0.
4.30	0.21533E 08	60.10	76.06	0.60785E 06	0.25565E 05	0.	0.
4.40	0.21533E 08	59.93	76.77	0.60784E 06	0.25565E 05	0.	0.
4.50	0.21533E 08	59.76	77.48	0.60783E 06	0.25565E 05	0.	0.
4.60	0.21533E 08	59.58	78.18	0.60782E 06	0.25565E 05	0.	0.
4.70	0.21533E 08	59.40	78.88	0.60781E 06	0.25566E 05	0.	0.
4.80	0.21533E 08	59.21	79.56	0.60780E 06	0.25565E 05	0.	0.
4.90	0.21533E 08	59.02	80.24	0.60779E 06	0.25565E 05	0.	0.
5.00	0.21533E 08	58.82	80.91	0.60779E 06	0.25565E 05	0.	0.
5.10	0.21533E 08	58.63	81.57	0.60778E 06	0.25565E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 5

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
5.20	.21533E 08	58.42	82.23	0.60777E 06	0.255654E 05	0.	0.
5.30	.21533E 08	58.22	82.88	0.60776E 06	0.255654E 05	0.	0.
5.40	.21533E 08	58.01	83.52	0.60775E 06	0.255654E 05	0.	0.
5.50	.21533E 08	57.80	84.15	0.60773E 06	0.255655E 05	0.	0.
5.60	.21533E 08	57.58	84.77	0.60772E 06	0.255655E 05	0.	0.
5.70	.21533E 08	57.37	85.39	0.60771E 06	0.255655E 05	0.	0.
5.80	.21533E 08	57.14	85.99	0.60770E 06	0.255655E 05	0.	0.
5.90	.21533E 08	56.92	86.59	0.60769E 06	0.255655E 05	0.	0.
6.00	.21533E 08	56.69	87.19	0.60768E 06	0.255655E 05	0.	0.
6.10	.21533E 08	56.46	87.77	0.60767E 06	0.255655E 05	0.	0.
6.20	.21533E 08	56.22	88.35	0.60766E 06	0.255655E 05	0.	0.
6.30	.21533E 08	55.99	88.92	0.60764E 06	0.255656E 05	0.	0.
6.40	.21533E 08	55.75	89.49	0.60763E 06	0.255656E 05	0.	0.
6.50	.21533E 08	55.51	90.04	0.60762E 06	0.255656E 05	0.	0.
6.60	.21533E 08	55.26	90.59	0.60761E 06	0.255656E 05	0.	0.
6.70	.21533E 08	55.01	91.13	0.60760E 06	0.255656E 05	0.	0.
6.80	.21533E 08	54.76	91.67	0.60758E 06	0.255656E 05	0.	0.
6.90	.21533E 08	54.51	92.20	0.60757E 06	0.255657E 05	0.	0.
7.00	.21533E 08	54.25	92.72	0.60756E 06	0.255657E 05	0.	0.
7.10	.21533E 08	53.99	93.23	0.60754E 06	0.255657E 05	0.	0.
7.20	.21533E 08	53.73	93.74	0.60753E 06	0.255657E 05	0.	0.
7.30	.21533E 08	53.47	94.24	0.60752E 06	0.255657E 05	0.	0.
7.40	.21533E 08	53.21	94.74	0.60750E 06	0.255657E 05	0.	0.
7.50	.21533E 08	52.94	95.22	0.60749E 06	0.255657E 05	0.	0.
7.60	.21533E 08	52.67	95.71	0.60747E 06	0.255658E 05	0.	0.
7.70	.21533E 08	52.40	96.18	0.60746E 06	0.255658E 05	0.	0.
7.80	.21533E 08	52.12	96.65	0.60745E 06	0.255658E 05	0.	0.
7.90	.21533E 08	51.85	97.11	0.60743E 06	0.255658E 05	0.	0.
8.00	.21533E 08	51.57	97.57	0.60742E 06	0.255658E 05	0.	0.
8.10	.21533E 08	51.29	98.02	0.60740E 06	0.255659E 05	0.	0.
8.20	.21533E 08	51.01	98.47	0.60739E 06	0.255659E 05	0.	0.
8.30	.21533E 08	50.73	98.91	0.60737E 06	0.255659E 05	0.	0.
8.40	.21533E 08	50.44	99.34	0.60736E 06	0.255659E 05	0.	0.
8.50	.21533E 08	50.15	99.77	0.60734E 06	0.255659E 05	0.	0.
8.60	.21533E 08	49.86	100.20	0.60732E 06	0.255659E 05	0.	0.
8.70	.21533E 08	49.57	100.62	0.60731E 06	0.255660E 05	0.	0.
8.80	.21533E 08	49.28	101.03	0.60729E 06	0.255660E 05	0.	0.
8.90	.21533E 08	48.99	101.44	0.60728E 06	0.255660E 05	0.	0.
9.00	.21533E 08	48.69	101.84	0.60726E 06	0.255660E 05	0.	0.
9.10	.21533E 08	48.39	102.24	0.60724E 06	0.255660E 05	0.	0.
9.20	.21533E 08	48.10	102.63	0.60723E 06	0.255661E 05	0.	0.
9.30	.21533E 08	47.80	103.02	0.60721E 06	0.255661E 05	0.	0.
9.40	.21533E 08	47.49	103.40	0.60719E 06	0.255661E 05	0.	0.
9.50	.21533E 08	47.19	103.78	0.60718E 06	0.255661E 05	0.	0.
9.60	.21533E 08	46.89	104.15	0.60716E 06	0.255661E 05	0.	0.
9.70	.21533E 08	46.58	104.52	0.60714E 06	0.255662E 05	0.	0.
9.80	.21533E 08	46.27	104.89	0.60712E 06	0.255662E 05	0.	0.
9.90	.21533E 08	45.97	105.25	0.60710E 06	0.255662E 05	0.	0.
10.00	.21533E 08	45.66	105.60	0.60709E 06	0.255662E 05	0.	0.
10.10	.21533E 08	45.34	105.96	0.60707E 06	0.255662E 05	0.	0.
10.20	.21533E 08	45.03	106.30	0.60705E 06	0.255663E 05	0.	0.
10.30	.21533E 08	44.72	106.65	0.60703E 06	0.255663E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 5

TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
10.40	0.21533E 08	44.4[illegible]	106.99	0.60701E 06	0.25563E 05	0.	0.
10.50	0.21533E 08	44.09	107.32	0.60699E 06	0.25563E 05	0.	0.
10.60	0.21533E 08	43.77	107.66	0.60698E 06	0.25564E 05	0.	0.
10.70	0.21533E 08	43.45	107.98	0.60696E 06	0.25564E 05	0.	0.
10.80	0.21533E 08	43.13	108.31	0.60694E 06	0.25564E 05	0.	0.
10.90	0.21533E 08	42.81	108.63	0.60692E 06	0.25564E 05	0.	0.
11.00	0.21533E 08	42.49	108.95	0.60690E 06	0.25564E 05	0.	0.
11.10	0.21533E 08	42.17	109.26	0.60688E 06	0.25565E 05	0.	0.
11.20	0.21533E 08	41.85	109.57	0.60686E 06	0.25565E 05	0.	0.
11.30	0.21532E 08	41.52	109.88	0.60684E 06	0.25565E 05	0.	0.
11.40	0.21532E 08	41.2[illegible]	110.18	0.60682E 06	0.25565E 05	0.	0.
11.50	0.21532E 08	40.87	110.48	0.60680E 06	0.25566E 05	0.	0.
11.60	0.21532E 08	40.55	110.78	0.60678E 06	0.25566E 05	0.	0.
11.70	0.21532E 08	40.22	111.08	0.60676E 06	0.25566E 05	0.	0.
11.80	0.21532E 08	39.89	111.37	0.60674E 06	0.25566E 05	0.	0.
11.90	0.21532E 08	39.56	111.66	0.60672E 06	0.25567E 05	0.	0.
12.00	0.21532E 08	39.23	111.94	0.60670E 06	0.25567E 05	0.	0.
12.10	0.21532E 08	38.90	112.22	0.60668E 06	0.25567E 05	0.	0.
12.20	0.21532E 08	38.57	112.50	0.60666E 06	0.25567E 05	0.	0.
12.30	0.21532E 08	38.23	112.78	0.60664E 06	0.25568E 05	0.	0.
12.40	0.21532E 08	37.9[illegible]	113.05	0.60661E 06	0.25568E 05	0.	0.
12.50	0.21532E 08	37.57	113.32	0.60659E 06	0.25568E 05	0.	0.
12.60	0.21532E 08	37.23	113.59	0.60657E 06	0.25568E 05	0.	0.
12.70	0.21532E 08	36.90	113.86	0.60655E 06	0.25569E 05	0.	0.
12.80	0.21532E 08	36.56	114.12	0.60653E 06	0.25569E 05	0.	0.
12.90	0.21532E 08	36.22	114.38	0.60651E 06	0.25569E 05	0.	0.
13.00	0.21532E 08	35.88	114.64	0.60648E 06	0.25569E 05	0.	0.
13.10	0.21532E 08	35.55	114.90	0.60646E 06	0.25570E 05	0.	0.
13.20	0.21532E 08	35.21	115.15	0.60644E 06	0.25570E 05	0.	0.
13.30	0.21532E 08	34.87	115.40	0.60642E 06	0.25570E 05	0.	0.
13.40	0.21532E 08	34.53	115.65	0.60639E 06	0.25570E 05	0.	0.
13.50	0.21532E 08	34.19	115.90	0.60637E 06	0.25571E 05	0.	0.
13.60	0.21532E 08	33.84	116.14	0.60635E 06	0.25571E 05	0.	0.
13.70	0.21532E 08	33.50	116.39	0.60633E 06	0.25571E 05	0.	0.
13.80	0.21532E 08	33.16	116.63	0.60630E 06	0.25572E 05	0.	0.
13.90	0.21532E 08	32.82	116.86	0.60628E 06	0.25572E 05	0.	0.
14.00	0.21532E 08	32.47	117.10	0.60626E 06	0.25572E 05	0.	0.
14.10	0.21532E 08	32.13	117.34	0.60623E 06	0.25572E 05	0.	0.
14.20	0.21532E 08	31.78	117.57	0.60621E 06	0.25573E 05	0.	0.
14.30	0.21532E 08	31.44	117.80	0.60619E 06	0.25573E 05	0.	0.
14.40	0.21532E 08	31.09	118.03	0.60616E 06	0.25573E 05	0.	0.
14.50	0.21532E 08	30.75	118.25	0.60614E 06	0.25573E 05	0.	0.
14.60	0.21532E 08	30.4[illegible]	118.48	0.60612E 06	0.25574E 05	0.	0.
14.70	0.21532E 08	30.05	118.70	0.60609E 06	0.25574E 05	0.	0.
14.80	0.21532E 08	29.7[illegible]	118.92	0.60607E 06	0.25574E 05	0.	0.
14.90	0.21532E 08	29.36	119.14	0.60605E 06	0.25575E 05	0.	0.
15.00	0.21532E 08	29.01	119.36	0.60602E 06	0.25575E 05	0.	0.
15.10	0.21532E 08	28.66	119.58	0.60600E 06	0.25575E 05	0.	0.
15.20	0.21532E 08	28.3[illegible]	119.79	0.60597E 06	0.25575E 05	0.	0.
15.30	0.21532E 08	27.96	120.01	0.60595E 06	0.25576E 05	0.	0.
15.40	0.21532E 08	27.61	120.22	0.60592E 06	0.25576E 05	0.	0.
15.50	0.21532E 08	27.26	120.43	0.60590E 06	0.25576E 05	0.	0.

TRAJECTORY PARAMETERS , TRAJECTORY NUMBER 5

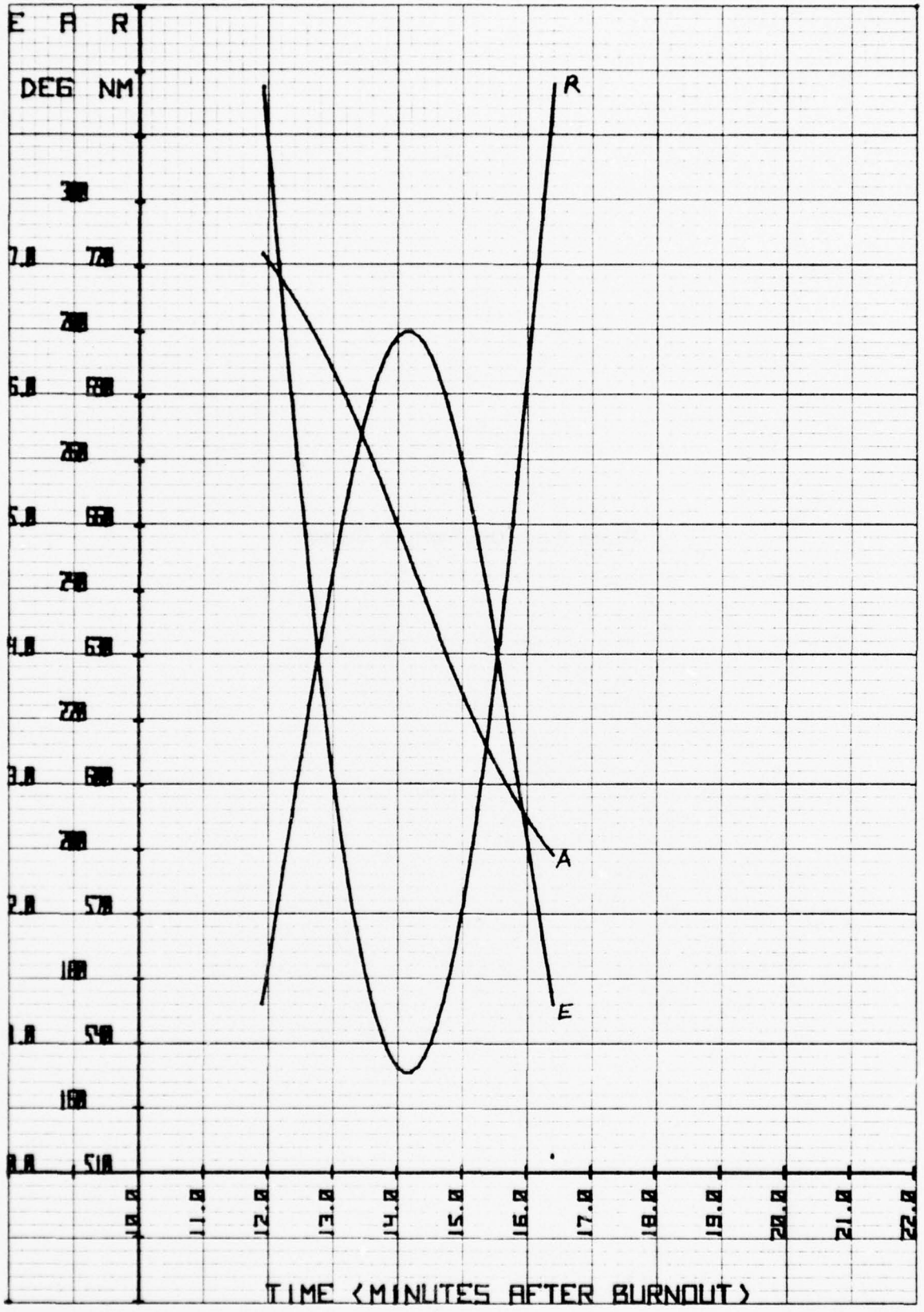
TIME(MIN)	RADIUS(FT)	LATITUDE(DEG)	LONGITUDE(DEG)	HEIGHT(FT)	VELOCITY(FT/S)	BAL.COEFF.(FT**2/SLG)	ATMOS.DENS.(SLG/FT**3)
15.60	.21532E 8	26.9	120.64	0.60587E 06	0.255677E 05	0.	0.
15.70	.21531E 08	26.85	120.84	0.60585E 06	0.255677E 05	0.	0.
15.80	.21531E 8	26.2	121.05	0.60582E 06	0.255677E 05	0.	0.
15.90	.21531E 08	25.85	121.25	0.60580E 06	0.255678E 05	0.	0.
16.00	.21531E 8	25.5	121.46	0.60577E 06	0.255678E 05	0.	0.
16.10	.21531E 08	25.14	121.66	0.60575E 06	0.255678E 05	0.	0.
16.20	.21531E 8	24.79	121.86	0.60572E 06	0.255678E 05	0.	0.
16.30	.21531E 08	24.44	122.06	0.60570E 06	0.255679E 05	0.	0.
16.40	.21531E 8	24.08	122.26	0.60567E 06	0.255679E 05	0.	0.
16.50	.21531E 08	23.73	122.45	0.60565E 06	0.255679E 05	0.	0.
16.60	.21531E 8	23.37	122.65	0.60562E 06	0.255680E 05	0.	0.
16.70	.21531E 08	23.02	122.84	0.60560E 06	0.255680E 05	0.	0.
16.80	.21531E 8	22.66	123.04	0.60557E 06	0.255680E 05	0.	0.
16.90	.21531E 08	22.31	123.23	0.60555E 06	0.255681E 05	0.	0.
17.00	.21531E 8	21.95	123.42	0.60552E 06	0.255681E 05	0.	0.
17.10	.21531E 08	21.60	123.61	0.60549E 06	0.255681E 05	0.	0.
17.20	.21531E 8	21.24	123.80	0.60547E 06	0.255681E 05	0.	0.
17.30	.21531E 08	20.88	123.98	0.60544E 06	0.255682E 05	0.	0.
17.40	.21531E 8	20.53	124.17	0.60542E 06	0.255682E 05	0.	0.
17.50	.21531E 08	20.17	124.36	0.60539E 06	0.255682E 05	0.	0.
17.60	.21531E 8	19.81	124.54	0.60536E 06	0.255683E 05	0.	0.
17.70	.21531E 08	19.45	124.73	0.60534E 06	0.255683E 05	0.	0.
17.80	.21531E 8	19.1	124.91	0.60531E 06	0.255683E 05	0.	0.
17.90	.21531E 08	18.74	125.09	0.60529E 06	0.255684E 05	0.	0.
18.00	.21531E 8	18.38	125.27	0.60526E 06	0.255684E 05	0.	0.
18.10	.21531E 08	18.02	125.45	0.60523E 06	0.255684E 05	0.	0.
18.20	.21531E 8	17.66	125.63	0.60521E 06	0.255685E 05	0.	0.
18.30	.21531E 08	17.3	125.81	0.60518E 06	0.255685E 05	0.	0.
18.40	.21531E 8	16.94	125.99	0.60515E 06	0.255685E 05	0.	0.
18.50	.21531E 08	16.59	126.17	0.60513E 06	0.255686E 05	0.	0.
18.60	.21531E 8	16.23	126.34	0.60510E 06	0.255686E 05	0.	0.
18.70	.21531E 08	15.87	126.52	0.60507E 06	0.255686E 05	0.	0.
18.80	.21531E 8	15.51	126.69	0.60505E 06	0.255686E 05	0.	0.
18.90	.21531E 08	15.15	126.87	0.60502E 06	0.255687E 05	0.	0.
19.00	.21531E 8	14.79	127.04	0.60499E 06	0.255687E 05	0.	0.
19.10	.21531E 08	14.42	127.21	0.60497E 06	0.255687E 05	0.	0.
19.20	.21531E 8	14.06	127.38	0.60494E 06	0.255688E 05	0.	0.
19.30	.21531E 08	13.7	127.56	0.60491E 06	0.255688E 05	0.	0.
19.40	.21531E 8	13.34	127.73	0.60488E 06	0.255688E 05	0.	0.
19.50	.21530E 08	12.98	127.90	0.60486E 06	0.255689E 05	0.	0.
19.60	.2153 E 8	12.62	128.07	0.60483E 06	0.255689E 05	0.	0.
19.70	.21530E 08	12.26	128.24	0.60480E 06	0.255689E 05	0.	0.
19.80	.2153 E 8	11.9	128.41	0.60478E 06	0.255690E 05	0.	0.
19.90	.21530E 08	11.54	128.57	0.60475E 06	0.255690E 05	0.	0.
20.00	.2153 E 8	11.17	128.74	0.60472E 06	0.255690E 05	0.	0.

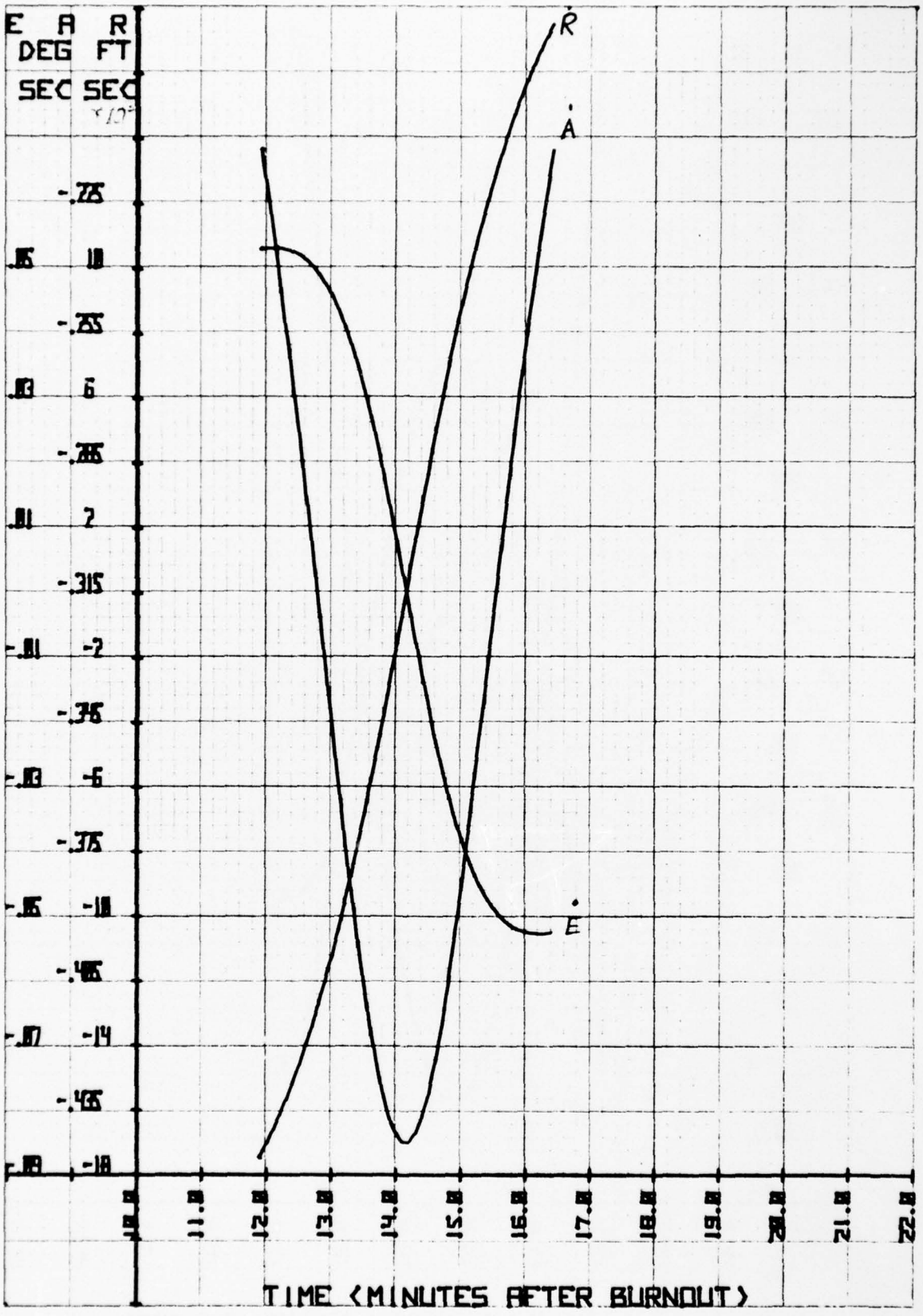
RADAR PARAMETERS , TRAJECTORY NUMBER 5 RADAR SITE 1 35.900 DEG,LAT. 233,33) DEG,LONG,

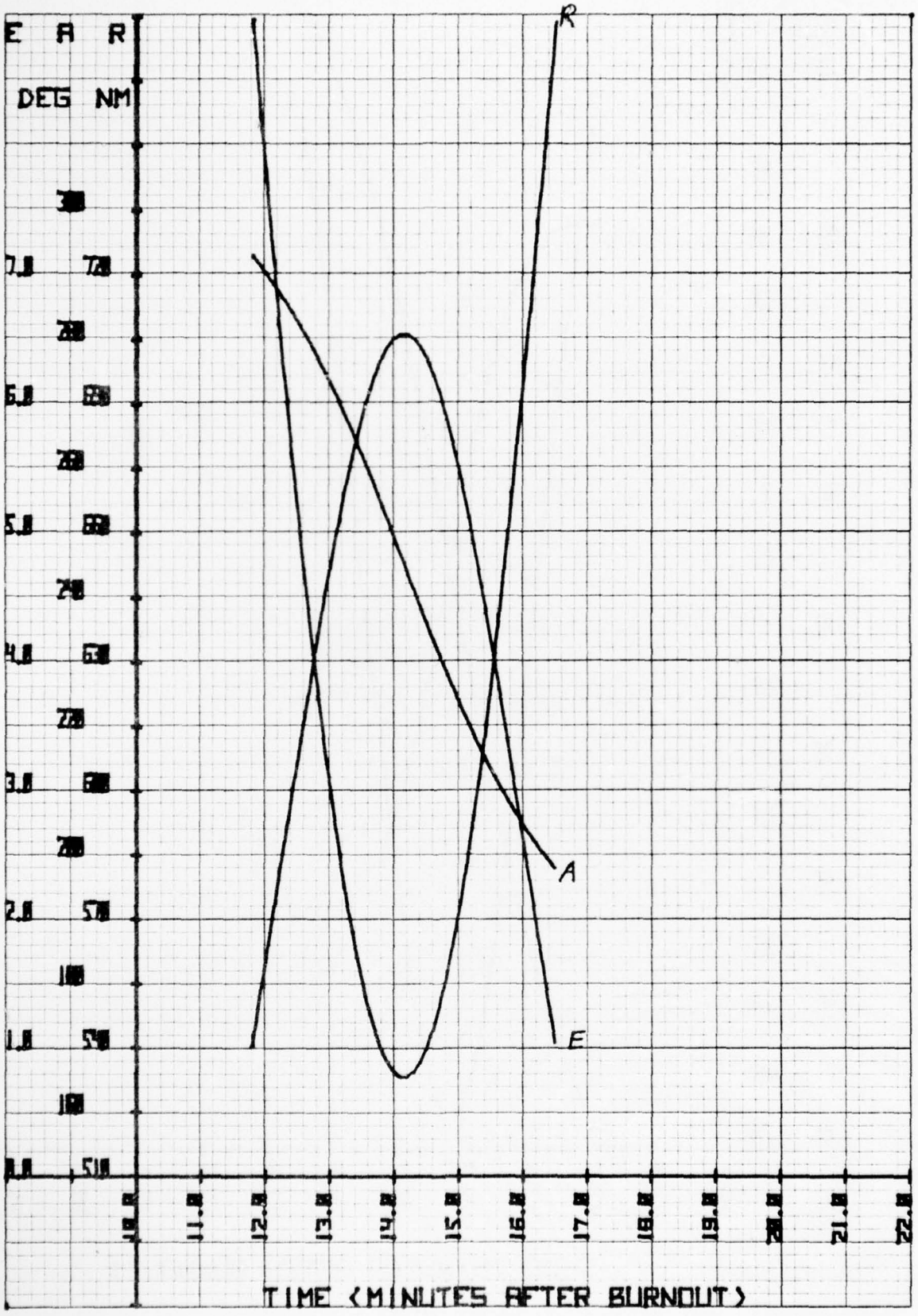
TIME (MIN)	SL RANGE (NM)	SL RANGE-RATE (FT/S)	ELEVATION (DEG)	EL RATE (DEG/S)	AZIMUTH (DEG)	AZ RATE (DEG/S)	RADIUS (ERU)	INERTIAL PHI (DEG)
11:90	0.761 68E 03	-0.174577E 05	1,29	0,5262E-01	291,65	+0,2130E 00	1,029	51,66
12:00	0.744029E 03	-0.170688E 05	1,60	0,5276E-01	290,34	+0,2231E 00	1,029	51,94
12:10	0.727389E 03	-0.166518E 05	1,92	0,5280E-01	288,97	+0,2336E 00	1,029	52,22
12:20	0.711174E 03	-0.162047E 05	2,24	0,5274E-01	287,54	+0,2446E 00	1,029	52,50
12:30	0.695416E 03	-0.157257E 05	2,55	0,5255E-01	286,04	+0,2564E 00	1,029	52,78
12:40	0.680148E 03	-0.152128E 05	2,87	0,5221E-01	284,47	+0,2680E 00	1,029	53,05
12:50	0.665413E 03	-0.146640E 05	3,18	0,5169E-01	282,82	+0,2803E 00	1,029	53,32
12:60	0.651218E 03	-0.140776E 05	3,49	0,5097E-01	281,10	+0,2929E 00	1,029	53,59
12:70	0.637631E 03	-0.134518E 05	3,79	0,5003E-01	279,31	+0,3058E 00	1,029	53,86
12:80	0.624682E 03	-0.127851E 05	4,09	0,4882E-01	277,43	+0,3190E 00	1,029	54,12
12:90	0.612411E 03	-0.120762E 05	4,37	0,4732E-01	275,48	+0,3323E 00	1,029	54,38
13:00	0.600861E 03	-0.113242E 05	4,65	0,4551E-01	273,44	+0,3455E 00	1,029	54,64
13:10	0.590079E 03	-0.105285E 05	4,92	0,4335E-01	271,33	+0,3587E 00	1,029	54,90
13:20	0.580096E 03	-0.968922E 04	5,17	0,4083E-01	269,14	+0,3715E 00	1,029	55,15
13:30	0.570966E 03	-0.880704E 04	5,41	0,3792E-01	266,87	+0,3838E 00	1,029	55,40
13:40	0.562727E 03	-0.788331E 04	5,63	0,3463E-01	264,54	+0,3955E 00	1,029	55,65
13:50	0.55542 E 03	-0.692018E 04	5,82	0,3096E-01	262,13	+0,4068E 00	1,029	55,90
13:60	0.549081E 03	-0.592063E 04	6,00	0,2691E-01	259,66	+0,4161E 00	1,029	56,14
13:70	0.543745E 03	-0.488848E 04	6,15	0,2252E-01	257,14	+0,4240E 00	1,029	56,39
13:80	0.539442E 03	-0.382835E 04	6,27	0,1782E-01	254,57	+0,4316E 00	1,029	56,63
13:90	0.536196E 03	-0.274562E 04	6,36	0,1287E-01	251,96	+0,4374E 00	1,029	56,86
14:00	0.534028E 03	-0.164631E 04	6,42	0,7735E-02	249,33	+0,4408E 00	1,029	57,10
14:10	0.532955E 03	-0.536933E 03	6,45	0,2482E-02	246,68	+0,4426E 00	1,029	57,34
14:20	0.532970E 03	0.575714E 03	6,45	-0,2809E-02	244,02	+0,4426E 00	1,029	57,57
14:30	0.534085E 03	0.168472E 04	6,42	-0,8058E-02	241,37	+0,4407E 00	1,029	57,80
14:40	0.536291E 03	0.278328E 04	6,35	-0,1319E-01	238,74	+0,4369E 00	1,029	58,03
14:50	0.539578E 03	0.386491E 04	6,26	-0,1812E-01	236,13	+0,4315E 00	1,029	58,25
14:60	0.543912E 03	0.492362E 04	6,14	-0,2280E-01	233,56	+0,4244E 00	1,029	58,48
14:70	0.549282E 03	0.595417E 04	5,99	-0,2718E-01	231,04	+0,4158E 00	1,029	58,70
14:80	0.555652E 03	0.695167E 04	5,81	-0,3120E-01	228,57	+0,4061E 00	1,029	58,92
14:90	0.562997E 03	0.791264E 04	5,61	-0,3486E-01	226,17	+0,3952E 00	1,029	59,14
15:00	0.571256E 03	0.883404E 04	5,39	-0,3813E-01	223,83	+0,3835E 00	1,029	59,36
15:10	0.580412E 03	0.971377E 04	5,16	-0,4101E-01	221,57	+0,3712E 00	1,029	59,58
15:20	0.590414E 03	0.105505E 05	4,90	-0,4351E-01	219,38	+0,3588E 00	1,029	59,79
15:30	0.601221E 03	0.113436E 05	4,64	-0,4565E-01	217,27	+0,3459E 00	1,029	60,01
15:40	0.612788E 03	0.120930E 05	4,36	-0,4744E-01	215,24	+0,3320E 00	1,029	60,22
15:50	0.625074E 03	0.127993E 05	4,07	-0,4892E-01	213,28	+0,3188E 00	1,029	60,43
15:60	0.638036E 03	0.134634E 05	3,77	-0,5011E-01	211,41	+0,3057E 00	1,029	60,64
15:70	0.651633E 03	0.140866E 05	3,47	-0,5104E-01	209,62	+0,2928E 00	1,029	60,84
15:80	0.665826E 03	0.146705E 05	3,16	-0,5175E-01	207,90	+0,2802E 00	1,029	61,05
15:90	0.680576E 03	0.152168E 05	2,85	-0,5225E-01	206,25	+0,2679E 00	1,029	61,25
16:00	0.695847E 03	0.157273E 05	2,53	-0,5258E-01	204,68	+0,2561E 00	1,029	61,46
16:10	0.711605E 03	0.162040E 05	2,22	-0,5276E-01	203,18	+0,2447E 00	1,029	61,66
16:20	0.727818E 03	0.166488E 05	1,90	-0,5281E-01	201,74	+0,2337E 00	1,029	61,86
16:30	0.744455E 03	0.170636E 05	1,58	-0,5276E-01	200,37	+0,2232E 00	1,029	62,06
16:40	0.761487E 03	0.174504E 05	1,27	-0,5262E-01	199,07	+0,2132E 00	1,029	62,26

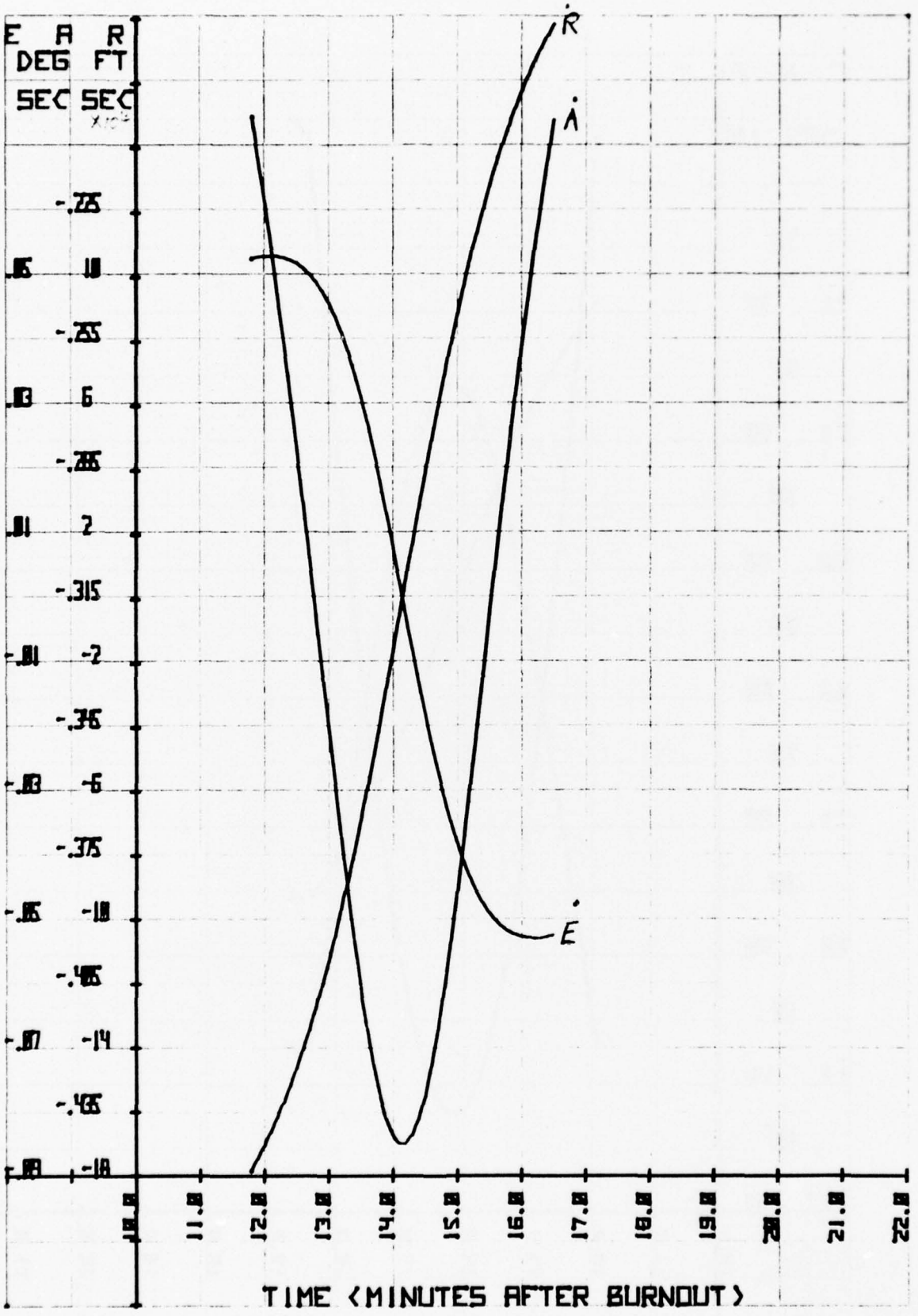
Plots from the Sample Output

Traj. 1








E A R
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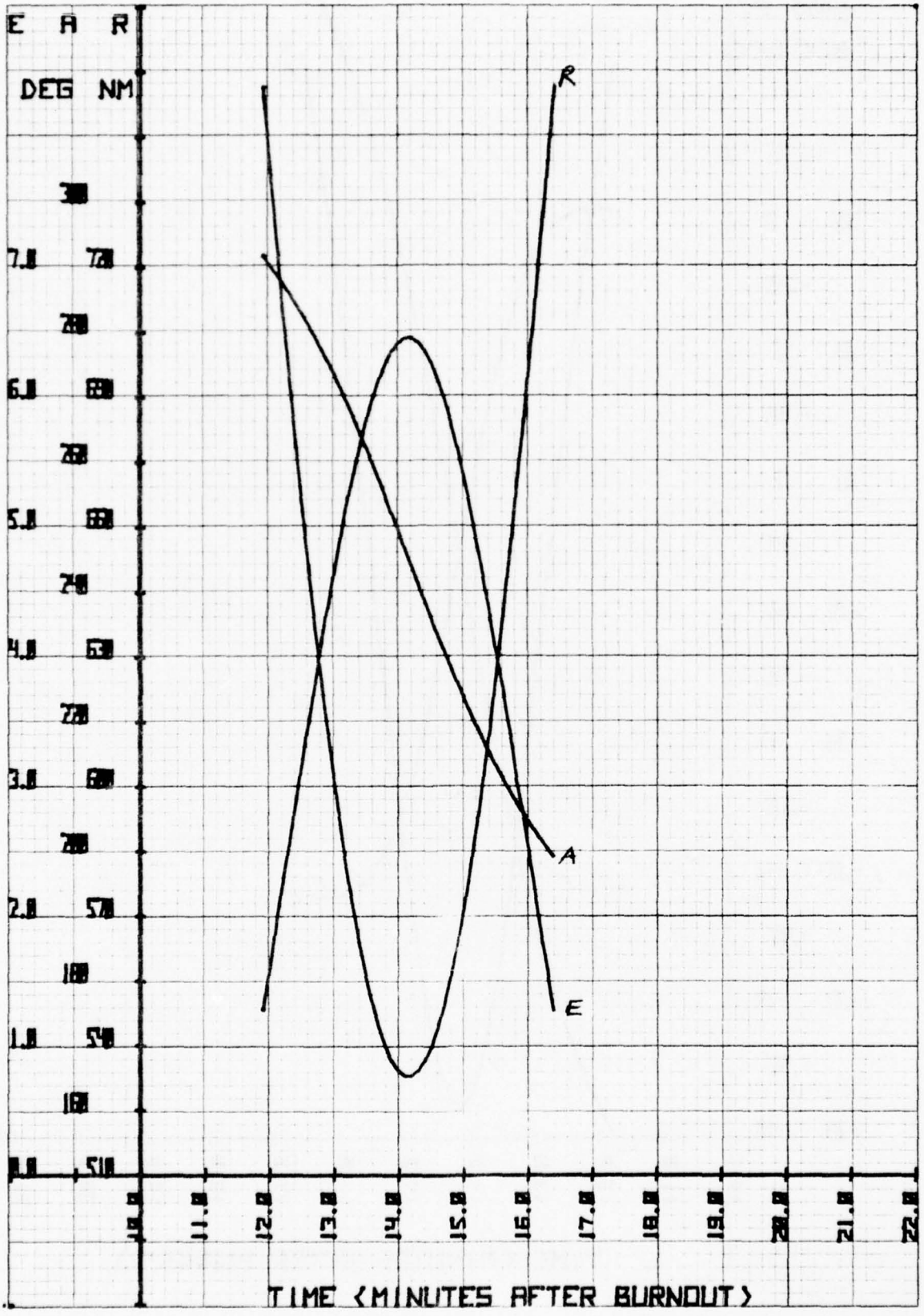
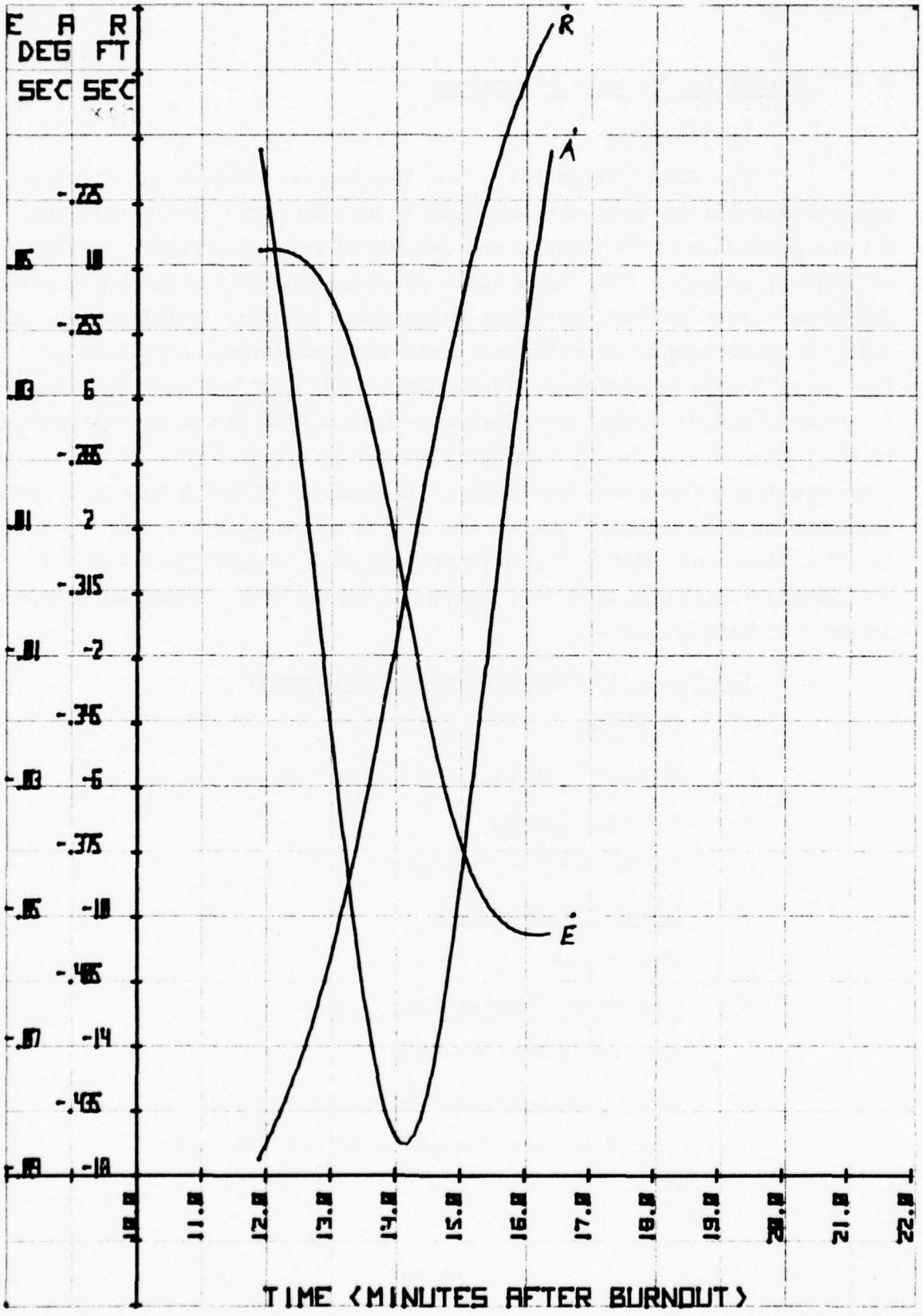
TIME (MINUTES AFTER BURNOUT)

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TIME (MINUTES AFTER BURNOUT)

C. Cobra Talon Trajectory Program

1. Introduction

The Cobra Talon Trajectory Program is a modification of the general perturbation program developed at RADC by Mr. George A. Ellis for the prediction of the position and velocity of an earth-orbiting satellite or ballistic missile. The Cobra Talon program was used to furnish data for the study associated with the Cobra Talon radar project. It differs from Mr. Ellis' program primarily in the use of the first trajectory as the nominal trajectory for the perturbation calculations. PRC/ISC has made the necessary modifications to the Cobra Talon program so that it can be implemented on the interactive system for the RADC Radar Simulator. The reader is referred to two documents for further information: "COBRA TALON STUDY COMPUTER PROGRAMS," by John C. Cleary and Leonard C. Gratch, RADC/OC-TM-71-4, and "SIMULATION PROGRAM FOR THREE DEGREES OF FREEDOM TRAJECTORIES," by George A. Ellis, et al, Technical Memorandum No. EMA-TM-66-5.

2. Computer Program Operating Environment

a. Computer

Honeywell 6000.

b. Source Language

FORTRAN Y under GCOS.

c. Memory Requirement

16 K words

d. Typical Processing Time Required

0.25 hours (900 seconds)

e. Peripheral Equipment Requirement

Four disc files (file codes: 02, 03, 04, 07).

f. Non-system Subroutines Required

ATMOSP	Atmospheric model.
CONVER	Conversion of trajectory to radar coordinates.
EQTNX	Computation of acceleration components.
ICERBM	Performs initialization for trajectory computations.
INPUTT	Input subroutine.
OUTPUT	Stores trajectory data in an array for outputting.
PRINT2	Prints out trajectory and radar data.
RKG	Performs 4th order Runge-Kutta-Gill integration of equations of motion.
SAVE	Outputs trajectory and radar data onto files.

3. Inputs

The following is the set of input parameters required for the Cobra Talon Trajectory Program:

NAMELIST IN1

TM - Maximum forward trajectory run time (minutes)

TMI - Cut-off time for backwards trajectory (minutes)

NAMELIST IN2

CA - Surface range - dummy variable (degrees)

BETA - Missile heading angle measured clockwise from north (degrees).

GAM - Missile re-entry angle relative to vertical (degrees).

HX - Height of missile at burnout (feet), referenced to earth's surface.

NAMELIST IN3

KZ - Program control variable.

=0 differences are calculated relative to third trajectory.

=1 differences are calculated relative to first trajectory.

NAMELIST IN4

ELIM - Maximum co-latitude of elevation angle for which radar coverage parameters are determined (degrees).

NAMELIST IN5

VO - Initial velocity of missile (ft./min.).

INERTL - Initial velocity option variable.
=1, initial velocity is inertial velocity (SATELLITE orbit).
=0, initial velocity is burnout velocity (MISSILE trajectories)

NAMELIST IN6

ZK - ZK=g/2Bc (Bc=ballistic coefficient in lbs./ft.^{2} and g=32.2 ft./sec.^{2}), measured in ft.^{2}/slugs.

KAT - Atmospheric model option variable.
=0, sets the atmospheric density to zero.
=1, use the atmospheric model.

NAMELIST IN7

A - Out of trajectory plane perturbation, + ejected to the left of nominal trajectory (ft./sec.)

B - In plane perturbation, + ejected backward from nominal trajectory (ft./sec.).

C - In plane perturbation, + ejected upwards from nominal trajectory (ft./sec.).

MM - MM=3 gives nominal trajectory, MM greater than 3 gives MM minus 3 perturbed trajectories.

NAMELIST IN8

SC1 - Radar latitude (positive north and negative south of equator) (degrees).

SC2 - Radar longitude west of Greenwich (degrees).

AH - Altitude above sea level of radar (feet).

NAMELIST IN9

GLAM - Launch longitude east of Greenwich (degrees).

THE - Launch latitude (positive north and negative south of equator in degrees).

GLAMI - Impact longitude east of Greenwich (degrees).

THEI - Impact latitude (positive north and negative south of equator, in degrees).

4. Output

Output from the Cobra Talon Trajectory Program first consists of a printout of the input data for the computer run. Secondly, the output consists of a printout of data generated for the first trajectory. This data is printed out as a list of trajectory parameters (e.g., radius, latitude, longitude, etc.) versus incremental trajectory time points (generally separated by 0.1 min. increments) from start time to end time. If the target, whose trajectory has been generated, is detected by a radar site, a listing of the radar parameters computed for the site, from initial time of detection to time of leaving coverage, is also produced. A description of the complete set of output quantities for the first trajectory follows:

Output Parameter	Units	Description
Time	Min.	The time from burnout of the missile along its trajectory or time from the initiation of the satellite orbit, if that is appropriate.
Radius	Ft.	Earth-centered radius of the trajectory or the distance of the missile or satellite from the earth center at the time point above.
Latitude	Deg.	Position in latitude of the missile/satellite in its trajectory at the above time point.
Longitude	Deg.	Position in longitude of the missile/satellite, east of Greenwich.
Height	Ft.	Altitude above sea level of the missile.
Velocity	Ft./Sec.	Inertial velocity of the missile/satellite along its trajectory.

Output Parameter	Units	Description
R(Sea Level)	Ft.	Radius of spherical earth model.
Density	Slugs/Ft.^{3}	Atmospheric density.
R-Dot	Ft./Sec.	Geocentric radial component of velocity.
Lat.-Dot	Deg./Sec.	Geocentric latitude component of velocity.
Long.-Dot	Deg./Sec.	Geocentric longitude component of velocity.
R-Dot Dot	Ft./Sec.^{2}	Geocentric radial component of acceleration.
Lat.-Dot Dot	Deg./Sec.^{2}	Geocentric latitude component of acceleration.
Long.-Dot Dot	Deg./Sec.^{2}	Geocentric longitude component of acceleration.

If the target of the first trajectory is detected by radar, the trajectory in terms of radar coordinates is printed out as follows:

Time	Min.	Same as for Time described above.
Slant Range	Ft.	Radar slant range to the missile/satellite for the time point.
Sl Range Rate	Ft./Sec.	Radar slant range rate.
Sl Range R Dot	Ft./Sec.^{2}	Radar slant range acceleration.
Azimuth	Deg.	Radar azimuth look-angle to missile, measured clockwise from north.
Az Rate	Deg./Sec.	Radar azimuth angle rate.
Az R Dot	Deg./Sec.^{2}	Radar azimuth angle acceleration.
Elevation	Deg.	Radar elevation look-angle to missile.
El Rate	Deg./Sec.	Radar elevation angle rate.
El R Dot	Deg./Sec.^{2}	Radar elevation angle acceleration.
Reentry Angle	Deg.	Missile re-entry angle.
Heading	Deg.	Missile heading angle.

If more than one trajectory is generated in the computer run, the above set of trajectory data will be computed for the second, third, etc., trajectories also. Radar parameters for the targets corresponding to the trajectories will also be calculated, if the targets are detected.

Following the last set of trajectory and radar data, radar parameter differences may be calculated and printed out. These differences will be produced for each perturbed trajectory when MM is greater than or equal to 4. The parameter differences represent the values obtained by subtracting the radar parameters for the perturbed trajectories from the corresponding parameters for the nominal trajectory (trajectory #1 or #3). Below is a list of the output quantities comprising the radar parameter differences:

Output Parameter	Units	Description
Time	Min.	Same as for Time described previously.
Slant Range (Δ R)	Ft.	Difference in radar slant range (nominal trajectory slant range - perturbed trajectory slant range).
Sl Range Rate ($\Delta \dot{R}$)	Ft./Sec.	Difference in radar slant range rate.
Sl Range Rate Dot ($\Delta \ddot{R}$)	Ft./Sec.^{2}	Difference in radar slant range acceleration.
Azimuth (Δ A)	Deg.	Difference in radar azimuth look-angle to missile.
Azimuth Rate ($\Delta \dot{A}$)	Deg./Sec.	Difference in radar azimuth angle rate.
Azimuth Rate Dot ($\Delta \ddot{A}$)	Deg./Sec.^{2}	Difference in radar azimuth acceleration.
Elevation (Δ E)	Deg.	Difference in radar elevation look-angle to missile.
Elevation Rate ($\Delta \dot{E}$)	Deg./Sec.	Difference in radar elevation angle rate.
Elevation Rate Dot ($\Delta \ddot{E}$)	Deg./Sec.^{2}	Difference in radar elevation angle acceleration.
Angular Separation in Radar Beam	Deg.	Total angular separation in the radar beam.

The reader is referred to the sample output for an illustration of the printout format. The set of trajectory and radar parameters for the first trajectory only is included there, as is the set of radar parameter differences for the first perturbed trajectory only.

5. Sample Job Stream

The sample job stream on the following page is set up for producing plots of radar data from the first trajectory. This data is placed on file STORE1 and would be punched out onto cards for plotting by means of the Hewlett-Packard 9820A calculator/plotter if plots were desired. If plots are not wanted, line 80 of the job stream could be replaced by 0080$; DISC: 02, X1R, 10L.

```
0010$:IDENT:CLEARY,CØNTI     ,65121104RADC
0020$:USERID:CLEARY$THREE
0030$:LØVLØAD
0040$:ØPTIØN:FØRTRAN
0050$:SELECT:CLEARY/ØTRAJT
0060$:EXECUTE
0070$:LIMITS:40,16K,,15000
0080$:PRMFL:02,R/W,L,CLEARY/STØRE1
0090$:DISC:03,X2R,50L
0100$:DISC:04,X3R,10L
0110$:DISC:07,X4R,10L
0120$:DATA:05
0130 $IN1
0140  TM=44.0D0,
0150 TMI = 0.0D0,
0160 $END
0170 $IN2
0180  CA=91.5651D0,BETA=278.0D0,
0190  GAM=55.0D0,HX=4.0D5,
0200 $END
0210 $IN3
0220 KZ=1,
0230 $END
0240 $IN4
0250 ELIM = 39.5D0,
0260 $END
0270 $IN5
0280  V0=1.056D6,
0290  INERTL=0,
0300 $END
0310 $IN6
0320  ZK=0.321D-1,KAT=1,
0330 $END
0340 $IN7
0350  A=7*0.0D0,5.0D0,2*3.533D0,
0360  B=4*0.0D0,5.0D0,3.533D0,-3.533D0,0.0D0,3.533D0,-3.533D0,
0370  C=3*0.0D0,5.0D0,0.0D0,2*3.533D0,3*0.0D0,
0380  MM=8,
0390 $END
0400 $IN8
0410 SC1=13.2D0,SC2=0.53333334D0,
0420 AM = 0.0D0,
0430 $END
0440 $IN9
0450 GLAM=27.0D0,THE=42.5D0,
0460 GLAMI=60.0D0,     THEI=-40.0D0,
0470 $END
0480$:ENDJØB
0490***EØF
```

Sample Job Stream for the Cobra Talon Trajectory Program

RADC 635/645 BATCH JOB

$NUMB NUMBER	DATE	TIME
	1/7/76	1000

PROGRAMMER	TELEPHONE
Conti	339-1360

RADC ENGINEER	TELEPHONE	SYMBOL
Cleary	3573	OCSA

TAPES ASSIGNED

REEL NO.	WRITE	READ	DEN.	TITLE
None				

PERIPHERALS ASSIGNED
[X] READER [X] PRINTER [ ] PUNCH
[X] DISC # OF LINKS 80 [ ] DRUM # OF LINKS ____

CORE SIZE 16K	ACTIVITIES 1
PROCESSOR TIME 0,25	ESTIMATED LINES OF PRINT 10,000
TOTAL RUN TIME 0,50	

DECKS EXPECTED

NO. OF BINARY DECKS None	NO. OF COMDECKS

BMC **TAPE** [ ] DUMP [ ] COPY

FROM:	TO:	MODE [ ] BCD [ ] BINARY	NO. OF FILES

SPECIAL OPERATOR INSTRUCTIONS

(Use reverse side if required)

RADC FORM APR 69 **0-56** PREVIOUS EDITION WILL BE USED

HIS 6000 Batch Submittal Form

Source Listing of the Cobra Talon Trajectory Program

```
3066T 81  01-07-76   15.345

C       PROGRAM TRAJ CONVERTED    TALON CLEARY                          00001000
        DOUBLE PRECISION X,XD,XDD,TO,TM                                 00001010
        DOUBLE PRECISION TC,TI,MK,TM                                    00001020
        DOUBLE PRECISION ARRAY,SC1,SC2,T,H,XYZ,RSL,PZ,R,W,P,Q           00001030
        DOUBLE PRECISION ARRAY1                                         00001040
        DOUBLE PRECISION TN,STN                                         00001050
        DOUBLE PRECISION RADANG                                         00001060
        COMMON/TS/T,H,XYZ,RSL,PZ                                        00001070
        COMMON/A/R,W                                                    00001080
        COMMON/ST/P(3),Q(3)                                             00001090
        COMMON/BS/ X(3), XD(3), XDD(3)                                  00001100
        COMMON/AX/TM,M                                                  00001110
        COMMON ISW                                                      00001120
        COMMON/PARAM/ARRAY(20),MAX1,MAX2,SC1,SC2,ARRAY1(20)             00001130
        COMMON/NTRAJ/MM                                                 00001140
        COMMON/SW1/KZ                                                   00001150
C         KZ .NE. 1 GIVES ORIGINAL PROGRAM                              00001160
        CALL INPUTT                                                     00001170
        ICTR = 3                                                        00001180
        ISW = 0                                                         00001190
        CALL FLGEOF (02,IEOFN)                                          00001200
        CALL FLGEOF (07,IEOFP)                                          00001210
        R = 20925640.00                                                 00001220
        W=0.43752690480-2                                               00001230
        MK=5.72961D1                                                    00001240
        ITM = MM                                                        00001250
  4     DO 17 M = 1,ITM                                                 00001260
        IF(KZ.NE.1) GO TO 540                                           00001270
        IF(M.EQ.2) GO TO 17                                             00001280
        IF(M.EQ.3) GO TO 17                                             00001290
  540   CONTINUE                                                        00001300
        CALL SAVE(Q)                                                    00001310
        CALL ICERBM(R)                                                  00001320
        DO 11 I=1,3                                                     00001330
        P(I) = 0.0D0                                                    00001340
   11   Q(I) = 0.0D0                                                    00001350
        IF(M.EQ.2)GO TO 6                                               00001360
        TO=.1D-1                                                        00001370
        IT=10                                                           00001380
        KA=0                                                            00001390
        KB=0                                                            00001400
20      DO 16 K=1,60                                                    00001410
        DO 1 K9=1,IT                                                    00001420
        IF(H.LT.0.0D0)GO TO 2                                           00001430
9       CALL RKG(TO)                                                    00001450
          T = T+ TO                                                     00001460
        CALL EQTNX                                                      00001470
        IF(T-TM)1,2,2                                                   00001480
1       CONTINUE                                                        00001490
        IF(M.GE.3) GO TO 3                                              00001500
        CALL OUTPUT(K1)                                                 00001510
        CALL CONVER                                                     00001520
```

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0066T 01  01-07-76   15,345

      IF(PZ.NE.0.0D0)GO TO 92                                          00001530
      GO TO 16                                                         00001540
92    IF(KA.EQ.1)GO TO 94                                              00001550
      KA=1                                                             00001560
      YB=T                                                             00001570
      YO=.1D-2                                                         00001580
       IT = 1000                                                       00001590
      GO TO 16                                                         00001600
94    IF(H-2.0D3)96,96,16                                              00001610
96    IF(KB.EQ.1)GO TO 16                                              00001620
      KB=1                                                             00001630
      YI=T                                                             00001640
      YO=.1D-2                                                         00001650
       IT = 1000                                                       00001660
      GO TO 16                                                         00001670
    3 CALL OUTPUT(K1)                                                  00001680
      CALL CONVER                                                      00001690
      IF(PZ.NE.0.0D0)GO TO 62                                          00001700
      GO TO 16                                                         00001710
62    IF(H-2.0D3)63,63,64                                              00001720
63    YO=.1D-2                                                         00001730
      IY=1                                                             00001740
      GO TO 16                                                         00001750
64    YO=.1D-2                                                         00001760
       IT = 1000                                                       00001770
16    CONTINUE                                                         00001780
      GO TO 20                                                         00001790
2     IF(M.EQ.1)GO TO 80                                               00001800
      CALL PRINT2(1)                                                   00001810
      CALL PRINT2(-1)                                                  00001820
      GO TO 17                                                         00001830
80    CALL PRINT2(1)                                                   00001840
       CALL PRINT2(-1)                                                 00001850
      GO TO 17                                                         00001860
60    YO=-.1D-2                                                        00001870
      IY=1                                                             00001880
70    DO 18 K6=1,60                                                    00001890
      DO 40 K8=1,IT                                                    00001900
      IF(T.LE.0.0D0)GO TO 86                                           00001910
      GO TO 10                                                         00001920
86    CALL PRINT2(1)                                                   00001930
      GO TO 17                                                         00001940
10    CALL RKG(TO)                                                     00001950
        T = T+ TO                                                      00001960
      CALL EQTNX                                                       00001970
40    CONTINUE                                                         00001980
      CALL OUTPUT(K1)                                                  00001990
      TX=DABS(T-TI)                                                    00002000
      IF(TX.LE..1D-4)GO TO 42                                          00002010
      IF(T.LE.TI)GO TO 44                                              00002020
      GO TO 18                                                         00002030
42    IY=20                                                            00002040
```

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3066T 81  01-07-76   15.345

      PD=-.1D-2                                                          00002050
      GO TO 18                                                           00002060
44    PX=DABS(T-TC)                                                      00002070
      IF(TX.LE..1D-4)GO TO 46                                            00002080
      GO TO 18                                                           00002090
46    IT=10                                                              00002100
      PD=-.1D-1                                                          00002110
18    CONTINUE                                                           00002120
      GO TO 70                                                           00002130
17    CONTINUE                                                           00002140
  22  END FILE 2                                                         00002150
      REWIND 2                                                           00002160
       END FILE 7                                                        00002170
       REWIND 7                                                         00002180
      READ (02) ARRAY                                                    00002190
      IF(IEOFN) 305,69,305                                               00002200
  69  STN = ARRAY(1)                                                     00002210
      SSTN = STN                                                         00002220
      STT = ARRAY(1)                                                     00002230
      PRINT 330                                                          00002240
 330  FORMAT(1H1,////////////////////66(2H* ),///38X,                    00002250
     *'RADAR PARAMETER DIFFERENCES(PERTURBED-NOMINAL)",                  00002260
     *2(/66(2H* ),/66(2H* ),/1H1)                                       00002270
       PRINT 440,M                                                      00002400
      PRINT 340                                                          00002410
      PRINT 337                                                          00002420
      PRINT 999                                                          00002430
      PRINT 345                                                          00002440
      PRINT 336                                                          00002450
      PRINT 999                                                          00002460
 999  FORMAT(1H )                                                        00002470
 440   FORMAT(1H1,20X,5H M = ,I4)                                        00002480
 340  FORMAT(1H0,4HTIME,4X,11HSLANT RANGE,7X,13HSL RANGE RATE,6X,17HSL R00002490
     1ANGE RATE DOT,7X,7HAZIMUTH,8X,12HAZIMUTH RATE)                    00002500
 345  FORMAT(10X,16HAZIMUTH RATE DOT,4X,9HELEVATION,8X,14HELEVATION RATE00002510
     1 6X,18HELEVATION RATE DOT)                                        00002520
 310  READ (07) ARRAY1                                                  00002530
      IF(IEOFP) 200,204,200                                             00002540
 204  STT1 = ARRAY1(1)                                                  00002550
 203  IF(STT.EQ.STT1) GO TO 250                                         00002560
      IF(STT.GT.STT1) GO TO 210                                         00002570
 214  READ (02) ARRAY                                                   00002580
      IF(IEOFN) 305,202,305                                             00002590
 202  STT = ARRAY(1)                                                    00002600
      GO TO 203                                                         00002610
 305  ICTR = ICTR + 1                                                   00002620
      IF(ITM.EQ.ICTR) GO TO 200                                         00002630
       PRINT 440,M                                                      00002640
      PRINT 340                                                          00002650
      PRINT 337                                                          00002660
      PRINT 999                                                          00002670
      PRINT 345                                                          00002680
```

```
0066T 8X  01-07-76   15.345

      PRINT 336                                                                 00002690
      PRINT 999                                                                 00002700
  387 FORMAT(2X,7HMINUTES,2X,4HFEET,14X,9HFEET/SEC,10X,12HFEET/SEC/SEC,00002710
     $2X,7HDEGREES,5X,11HDEGREES/SEC)                                           00002720
  336 FORMAT(10X,15HDEGREES/SEC/SEC,5X,7HDEGREES,10X,11HDEGREES/SEC,9X,00002730
     $15HDEGREES/SEC/SEC)                                                       00002740
      REWIND 2                                                                  00002750
      CALL FLGEOF (02,IEOFN)                                                    00002760
      IF (STT.LE.STT1) GO TO 333                                                00002770
      GO TO 201                                                                 00002780
  333 READ (07) ARRAY1                                                          00002790
      IF (IEOFP) 200,334,200                                                    00002800
  334 STT1=ARRAY1(1)                                                            00002810
      IF (STT.LE.STT1) GO TO 333                                                00002820
      READ (02) ARRAY                                                           00002830
      IF (IEOFN) 305,335,305                                                    00002840
  335 STT=ARRAY(1)                                                              00002850
      GO TO 203                                                                 00002860
  210 IF(SSTN.EQ.STT1) GO TO 212                                                00002870
      GO TO 310                                                                 00002880
  212 REWIND 2                                                                  00002890
      CALL FLGEOF (02,IEOFN)                                                    00002900
      GO TO 214                                                                 00002910
  250 DT = ARRAY(1)                                                             00002920
      DRS  = -  (ARRAY(2)-ARRAY1(2))                                            00002930
      DRSD = -  (ARRAY(3)-ARRAY1(3))                                            00002940
      DRSDD= -  (ARRAY(4)-ARRAY1(4))                                            00002950
      DSIG = -  (ARRAY(5)-ARRAY1(5))                                            00002960
      DSIGD= -  (ARRAY(6)-ARRAY1(6))                                            00002970
      DSIGDD =-    (ARRAY(7)-ARRAY1(7))                                         00002980
      DEL  = -  (ARRAY(8)-ARRAY1(8))                                            00002990
      DELD = -  (ARRAY(9)-ARRAY1(9))                                            00003000
      DELDD=  - (ARRAY(10)-ARRAY1(10))                                          00003010
       RADANG = DSQRT(DSIG**2 + DEL**2)                                         00003020
      PRINT 350,DT,DRS,DRSD,DRSDD,DSIG,DSIGD,DSIGDD,DEL,DELD,DELDD              00003030
       PRINT 700,RADANG                                                         00003040
      PRINT 999                                                                 00003050
  700  FORMAT(1H0,36H ANGULAR SEPRATION IN RADAR BEAM = ,D22.10)                 00003060
  350 FORMAT(F7.3,2X,D17.10,2X,D17.10,2X,D17.10,2X,D17.10,2X,D17.10/            00003070
     1           9X,D17.10,2X,D17.10,2X,D17.10,2X,D17.10)                       00003080
  201 READ (02) ARRAY                                                           00003090
      IF(IEOFN) 305,312,305                                                     00003100
  312 STT = ARRAY(1)                                                            00003110
      GO TO 310                                                                 00003120
  200 STOP                                                                      00003130
      END                                                                       00003140
```

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3520T B1  01-05-76   17.927

      SUBROUTINE EQTNX                                                  00003150
      DOUBLE PRECISION ARRAY,SC1,SC2,T,H,XYZ,RSL,PZ,R,W,P,Q             00003160
      DOUBLE PRECISION V6,EL2,EL3,EL4,EL5,EL6,AA                        00003170
      DOUBLE PRECISION DV,XYZ,ZK,S1,S2,S3,S4,S6,VA,VDD,VD,S23,Q1,Q2,Q3  00003180
      DOUBLE PRECISION X,XD,XDD                                         00003190
      DOUBLE PRECISION A,R,W                                            00003200
      DIMENSION DV(5)                                                   00003210
      COMMON/BS/X(3),XD(3),XDD(3)                                       00003220
      COMMON/TS/T,H,XYZ,RSL,PZ                                          00003230
      COMMON/A/R,W                                                      00003240
       COMMON/EQATMO/ZK,KAT                                             00003250
      DATA DV/2.42167D12,4*0.0D0/                                       00003260
      S6=2.0D0                                                          00003270
      S1=DCOS(X(2))                                                     00003280
      S2=DSIN(X(2))                                                     00003290
      S3=DSIN(S6*X(2))                                                  00003300
      S4=DCOS(S6*X(2))                                                  00003310
      RSL = R                                                           00003320
      W=  X(1)- RSL                                                     00003330
       IF(KAT.EQ.1) GO TO 21                                            00003340
   20  PZ = 0.0D0                                                       00003350
       GO TO 30                                                         00003360
   21  CALL ATMOSP                                                      00003370
   30 VA = (XD(1)*XD(1))/(X(1)*X(1))+XD(2)*XD(2)*(S1*(XD(3)+W))**2      00003380
      XYZ=X(1)*DSQRT(VA)                                                00003390
   22 VDD= XD(1)*XD(1)+ X(1)*XD(2)*X(1)*XD(2)+(X(1)*(XD(3)-W)*S1)**2    00003400
      VD=DSQRT(VDD)                                                     00003410
      S23=-PZ*ZK*VD                                                     00003420
      Q1= S23*XD(1)                                                     00003430
      Q2= S23*XD(2)                                                     00003440
      Q3=  S23*(XD(3)-W)                                                00003450
      V6 = R/X(1)                                                       00003460
      EL2=X(1)*XD(2)*XD(2)+0.5D0*(1.0D0+S4)*(W+XD(3))*(W+XD(3))*X(1)    00003470
      EL3=DV(1)/X(1)*V6+DV(2)/X(1)*V6**3*(3.0D0*S4-1.0D0)               00003480
      EL4=DV(3)/X(1)*V6**5*(35.0D0*S4*S4-10.0D0*S4-13.0D0)              00003490
      XDD(1)= EL2-EL3-EL4+Q1                                            00003500
      EL5=((-S6*XD(2)*XD(1))/X(1))-0.5D0*S3*(W+XD(3))*(W+XD(3))         00003510
      EL6=-DV(4)/(X(1)*X(1))*V6**3*S3+DV(5)/(X(1)*X(1))*V6**5*S3*(1.0D0-00003520
     17.0D0*S4)                                                         00003530
      XDD(2)=EL5+EL6+Q2                                                 00003540
      AA=-1.0D0*(W+XD(3))                                               00003550
      XDD(3)=AA*   (S6*XD(1)/X(1))-AA*(S6*XD(2)*S2)/S1+Q3               00003560
      RETURN                                                            00003570
      END                                                               00003580
```

```
2216T  01  01-27-76   11.192

      SUBROUTINE ICERBM(P)                                                  0 0 359
      DOUBLE PRECISION VO,RAT                                               0 0 360
      DOUBLE PRECISION RDP,RTDP,RLDP,C13,GMU,CA,GAM,BETA,GLAM,HX,THE,RO     0 0 361
      DOUBLE PRECISION X,XD,XDD                                             0 0 362
      DOUBLE PRECISION ARRAY,SC1,SC2,T,H,XYZ,RSL,PZ,R,W,P,Q                 0 0 363
      DOUBLE PRECISION P,GEO,GLAMD,ROD,THED                                 0 0 364
      DOUBLE PRECISION XN, XDN                                              0 0 365
      DOUBLE PRECISION COSGAM,COSBET,SINGAM,SINBET,V2,A,B,C                 0 0 366
      DOUBLE PRECISION  SNI,VBODR,VEO                                       0 0 367
      COMMON/BS/X(3),XD(3),XDD(3)                                           0 0 368
       COMMON/TS/T,H,XYZ,RSL,PZ                                             0 0 369
      COMMON/A/R,W                                                          0 0 370
       COMMON/IC/CA,BETA,GAM,HX,GLAM,THE,GLAMI,THEI                         0 0 371
       COMMON/PTURB/A(2 ),B(2 ),C(2 )                                       0 0 372
      COMMON/IC2/VO,INERTL                                                  0 0 373
       COMMON/SW1/KZ                                                        0 0 374
       COMMON/IC3/TMI                                                       0 0 375
       DIMENSION RDP(2 ),RLDP(2 ),RTDP(2 )                                  0 0 376
       DIMENSION XN(3),XDN(3)                                               0 0 377
       DIMENSION XN1(2 ),XDN1(2 )                                           0 0 378
       DOUBLE PRECISION GLAMI,THEI                                          0 0 379
       DOUBLE PRECISION TMI                                                 0 0 380
      DOUBLE PRECISION TN,STN,TM                                            0 0 381
      COMMON/AX/TM,M                                                        0 0 382
      C13=0.1745329251994329576923                                          0 0 383
      GMU=5.0675,4019                                                       0 0 384
      RO = R + HX                                                           0 0 385
       IF(M-2)6,1 ,15                                                       0 0 386
    6  CONTINUE                                                            0 0 387
      XD(1)=VO*DCOS(GAM*C13)                                                0 0 388
      XD(2)=VO/RO*DSIN(GAM*C13)*DCOS(BETA*C13)                              0 0 389
      RAT=RO*DCOS(THE*C13)                                                  0 0 390
      XD(3)=VO*DSIN(GAM*C13)*DSIN(BETA*C13)/RAT                             0 0 391
      IF(INERTL.EQ.1)XD(3)=XD(3)-W                                          0 0 3915
      X(1)=RO                                                               0 0 392
      X(2)= THE*C13                                                         0 0 393
      X(3)= GLAM*C13                                                        0 0 394
4     CALL EQTNX                                                            0 0 395
       CALL CONVER                                                          0 0 396
      CALL OUTPUT(K)                                                        0 0 397
       IF(KZ.NE.1) GO TO 3                                                  0 0 398
       DO 32 I=1,3                                                          0 0 399
       XN1(I) =X(I)                                                         0 0 400
       XDN1(I) = XD(I)                                                      0 0 401
   32  CONTINUE                                                            0 0 402
   30  CONTINUE                                                            0 0 403
      TN=TM                                                                 0 0 4035
      RETURN                                                                0 0 404
C                    TARGET LOCATION                                        0 0 405
   10  CONTINUE                                                            0 0 406
       X(2) = THEI*C13                                                      0 0 407
       X(3) = GLAMI*C13                                                     0 0 408
```

```
2216T V1  01-27-76   11.192

      TM = TMI                                                          0000409
      CALL OUTPUT(K)                                                    0000410
        RETURN                                                          0000411
16    T=0.0D0                                                           0000412
      TM= TN                                                            0000413
      IF(M.GT.3) GO TO 20                                               0000414
      DO 18 I = 1,3                                                     0000415
      XN(I) = X(I)                                                      0000416
      XDN(I) = XD(I)                                                    0000417
18    CONTINUE                                                          0000418
      CALL EQTNX                                                        0000419
      CALL OUTPUT(K)                                                    0000420
      RETURN                                                            0000421
20    IF(KZ.NE.1) GO TO 35                                              0000422
      DO 25 I=1,3                                                       0000423
      X(I) = XN1(I)                                                     0000424
      XD(I) = XDN1(I)                                                   0000425
      XN(I) = XN1(I)                                                    0000426
      XDN(I) = XDN1(I)                                                  0000427
25    CONTINUE                                                          0000428
      GO TO 45                                                          0000429
35    X(I) = XN(I)                                                      0000430
45    CONTINUE                                                          0000431
      SN1 = DCOS(XN(2)+C13)                                             0000432
      VBODR = DSQRT((XDN(1)/XN(1))**2 + XDN(2)*XDN(2)+(SN1*XDN(3))**2)  0000433
      VBO = XN(1) * VBODR                                               0000434
      BETA = DATAN2(XDN(3)*SN1 ,XDN(2))                                 0000435
      COSBET = DCOS(BETA)                                               0000436
      SINBET = DSIN(BETA)                                               0000437
      COSGAM = XDN(1) / VBO                                             0000438
      SINGAM = XDN(2) /(VBODR * COSBET)                                 0000439
      V2 = B(M)*SINGAM+C(M)*COSGAM                                      0000440
      RDP(M) = (-B(M)*COSGAM+C(M)*SINGAM)*60.0D0                        0000441
      RTDP(M) = (-V2*COSBET-A(M)*SINBET)*60.0D0                         0000442
      RLDP(M) = (-V2*SINBET+A(M)*COSBET)*60.0D0                         0000443
      XD(1) = XDN(1) + RDP(M)                                           0000444
      XD(2) = XDN(2) + RTDP(M)/XN(1)                                    0000445
      RATN = XN(1)* DCOS(XN(2)*C13)                                     0000446
      XD(3) = XDN(3) + RLDP(M)/RATN                                     0000447
      CALL EQTNX                                                        0000448
      CALL CONVER                                                       0000449
      CALL OUTPUT(K)                                                    0000450
      RETURN                                                            0000451
      END                                                               0000452
```

```
3608T 01  01-05-76  18.09

      SUBROUTINE ATMOSP                                              00004530
      DOUBLE PRECISION HP,H2P,SK3,HB,PB,SK1,SK2,CD,ST                00004540
      DOUBLE PRECISION TS,T,H,V,RSL,PZ,XYZ                           00004550
      COMMON/TS/T,H,XYZ,RSL,PZ                                       00004560
      HP=.3048D0*H                                                   00004570
      H2P=HP/(1.0D0+HP/6.356766D7)                                   00004580
      IF(HP-5.3D4)20,25,25                                           00004590
20    IF(HP-4.7D4)21,29,29                                           00004600
21    IF(HP-2.5D4)22,30,30                                           00004610
22    IF(HP-1.1D4)23,31,31                                           00004620
23    IF(HP)28,28,32                                                 00004630
25    IF(HP-7.9D4)33,33,26                                           00004640
26    IF(HP-9.0D4)34,34,27                                           00004650
27    IF(HP-1.05D5)35,35,28                                          00004660
28    PZ=0.0D0                                                       00004670
      G1=0.0D0                                                       00004680
      G2=0.0D0                                                       00004690
      G3=0.0D0                                                       00004700
      RETURN                                                         00004710
29    SK3=.120869D-3                                                 00004720
      HB=4.7D4                                                       00004730
      PB=2.8804D-6                                                   00004740
      GO TO 37                                                       00004750
30    SK1=.138466D-4                                                 00004760
      SK2=1.13883D1                                                  00004770
      PB=7.765D-5                                                    00004780
      HB=2.5D4                                                       00004790
      GO TO 36                                                       00004800
31    SK3=.157689D-3                                                 00004810
      HB=1.1D4                                                       00004820
      PB=7.062D-4                                                    00004830
      GO TO 37                                                       00004840
32    SK1=-0.225569D-4                                               00004850
      SK2=-5.25612D0                                                 00004860
      PB=2.37692D-3                                                  00004870
      HB=0.0D0                                                       00004880
      GO TO 36                                                       00004890
33    SK1=-0.159272D-4                                               00004900
      SK2=-7.59218D0                                                 00004910
      PB=1.39468D-6                                                  00004920
      HB=5.3D4                                                       00004930
      GO TO 36                                                       00004940
34    SK3=.216234D-3                                                 00004950
      HB=7.9D4                                                       00004960
      PB=4.1169D-6                                                   00004970
      GO TO 37                                                       00004980
35    SK1=.241458D-4                                                 00004990
      SK2=8.5412D0                                                   00005000
      PB=4.261D-9                                                    00005010
      HB=9.0D4                                                       00005020
36    CD=1.0D0+SK1*(H2P-HB)                                          00005030
      ST=-(1.0D0+SK2)                                                00005040
```

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3608I B1  01-05-76  18.09.0

      BZ=  PB*(CD**ST)                                          00005050
      RETURN                                                    00005060
37    BZ=PB*DEXP(-SK3*(H2P-HB))                                 00005070
      RETURN                                                    00005080
      END                                                       00005090
```

```
3684T 61  01-05-76   18.495

      SUBROUTINE OUTPUT(K)                                                  0000 5100
      DOUBLE PRECISION CC                                                   0000 5110
      DOUBLE PRECISION ARRAY,SC1,SC2,T,H,XYZ,RSL,PZ,R,W,P,Q                0000 5120
      DOUBLE PRECISION X,XD,XDD                                             0000 5130
      DOUBLE PRECISION ARRAY1                                               0000 5140
      COMMON/TS/T,H,XYZ,RSL,PZ                                              0000 5150
      COMMON/PARAM/ARRAY(20),MAX1,MAX2,SC1,SC2,ARRAY1(20)                   0000 5160
      COMMON/BS/X(3),XD(3),XDD(3)                                           0000 5170
      DATA CC/57.295779513.8232 876798155/                                  0000 5180
      ARRAY(1)=T                                                            0000 5190
      ARRAY(2)=X(1)                                                         0000 5200
      ARRAY(3)= X(2)*CC                                                     0000 5210
      ARRAY(4)= X(3)*CC                                                     0000 5220
      ARRAY(5)=H                                                            0000 5230
      ARRAY(6)=XYZ/ .6D2                                                    0000 5240
      ARRAY(7)=RSL                                                          0000 5250
      ARRAY(8)=PZ                                                           0000 5260
      ARRAY(9)=XD(1)/ .6D2                                                  0000 5270
      ARRAY(10)=XD(2)*CC/0.6D2                                              0000 5280
      ARRAY(11)=XD(3)*CC/0.6D2                                              0000 5290
      ARRAY(12)=XDD(1)/ .36D4                                               0000 5300
      ARRAY(13)=XDD(2)*CC/ .36D4                                            0000 5310
      ARRAY(14)=XDD(3)*CC/ .36D4                                            0000 5320
      CALL SAVE (1)                                                         0000 5330
      RETURN                                                                0000 5340
      END                                                                   0000 5350
```

```
66947 01  01-06-76    9.489

      SUBROUTINE SAVE (N)                                              00005360
      DOUBLE PRECISION ARRAY,SC1,SC2,ARRAY1                            00005370
      COMMON/PARAM/ARRAY(20),MAX1,MAX2,SC1,SC2,ARRAY1(20)              00005380
      IF(N)2,3,1                                                       00005390
3     MAX1= 0                                                          00005400
      MAX2= 0                                                          00005410
      REWIND 3                                                         00005420
      REWIND 4                                                         00005430
      RETURN                                                           00005440
1     WRITE (3) ARRAY                                                  00005450
      MAX1=MAX1+1                                                      00005460
      RETURN                                                           00005470
2     WRITE (4) ARRAY                                                  00005480
      MAX2=MAX2+1                                                      00005490
      RETURN                                                           00005500
      END                                                              00005510
```

```
6711T 61  01-06-76     9.573

      SUBROUTINE PRINT2(N)                                                    0  005520
      DOUBLE PRECISION ARRAY,SC1,SC2,ARRAY1                                   0  005530
       COMMON/SW1/KZ                                                          0  005540
       COMMON/AX/TM,Y                                                         0  005550
      COMMON/PARAM/ARRAY(20),MAX1,MAX2,SC1,SC2,ARRAY1(20)                     0  005560
       DOUBLE PRECISION TM                                                   0  005570
      IF(N)2,1,1                                                              0  005580
    1 REWIND 3                                                                0  005590
      IFLAG=0                                                                 0  005600
      DO 3 I=1,MAX1                                                           0  005610
      IF(IFLAG.NE.0)GO TO 5                                                   0  005620
   14 PRINT 1002                                                              0  005630
 1002 FORMAT(1H1,2X,4HTIME,7X,6HRADIUS,12X,8HLATITUDE,7X,9HLONGITUDE,         0  005640
     1 12X,8HHEIGHT,11X,8HVELOCITY,9X,12HR(SEA LEVEL),8X,7HDENSITY,//)        0  005650
      IFLAG=52                                                                0  005660
    5 READ (3) ARRAY                                                          0  005670
      PRINT 1000,(ARRAY(J),J=1,8)                                             0  005680
 1000 FORMAT(1X,F8.4,1X,D17.10,2X,D14.7,2X,D16.9,2X,D16.9,                    0  005690
     *2X,D17.10,1X,                                                          0  005692
     1D17.10,2X,D14.7)                                                       0  005700
    3 IFLAG=IFLAG-1                                                           0  005710
      REWIND 3                                                                0  005720
      IFLAG=0                                                                 0  005730
      DO 4 I=1,MAX1                                                           0  005740
      IF(IFLAG.NE.0)GO TO 7                                                   0  005750
    6 PRINT 1003                                                              0  005760
 1003 FORMAT(1H1,2X,4HTIME,9X,5HR-DOT,13X,8HLAT.-DOT,8X,9HLONG.-DOT,          0  005770
     1 10X,9HR-DOT DOT,9X,12HLAT.-DOT DOT,8X,13HLONG.-DOT DOT,//)             0  005780
      IFLAG=52                                                                0  005790
    7 READ (3) ARRAY                                                          0  005800
      PRINT 1001,ARRAY(1),(ARRAY(J),J=9,14)                                   0  005810
 1001 FORMAT(F8.4,2X,D16.9,4X,D13.6,4X,D13.6,4X,D16.9,4X,D16.7,4X,D16.7,     0  005820
     14X,D16.7)                                                              0  005830
    4 IFLAG=IFLAG-1                                                           0  005840
      RETURN                                                                  0  005850
    2 REWIND 4                                                                0  005860
      IFLAG=0                                                                 0  005870
      DO 10 I=1,MAX2                                                          0  005880
      IF(IFLAG.NE.0) GO TO 9                                                  0  005890
    8 PRINT 1008,SC1,SC2                                                      0  005900
 1008 FORMAT(1H1,35X,16HSENSOR-LATITUDE ,F9.5,5X,13HLONGITUDE(W),             0  005910
     1F10.5,/)                                                                0  005920
      PRINT 1004                                                              0  005930
 1004 FORMAT(2X,9HTIME(MIN),7X,15HSLANT RANGE(FT),3X,21HSL RANGE RATE(FT/     0  005940
     1/SEC),5X,25HSL RANGE ROOT(FT/SEC/SEC),3X,12HAZIMUTH(DEG),3X,            0  005950
     216HAZ RATE(DEG/SEC))                                                    0  005960
      IFLAG=52                                                                0  005970
    9 READ (4) ARRAY                                                          0  005980
      PRINT 1005,(ARRAY(J),J=1,6)                                             0  005990
 1005 FORMAT(F8.4,   D21.12,D21.12,D24.12,5X,D16.9,4X,D12.5)                  0  006000
   10 IFLAG=IFLAG-1                                                           0  006010
      REWIND 4                                                                0  006020
```

```
$711T 01  01-06-76    9.573

      IFLAG=0                                                                  00006030
      DO 11 I=1,MAX2                                                           00006040
      IF(IFLAG.NE.0)GO TO 13                                                   00006050
   12 PRINT 1006                                                               00006060
 1006 FORMAT(1H1,2X,9HTIME(MIN),2X,20HAZ RDOT(DEG/SEC/SEC),3X,14HELEVATI00006070
     1ON(DEG),5X,16HEL RATE(DEG/SEC),3X,20HEL RDOT(DEG/SEC/SEC),2X,13HRE00006080
     2NTRY ANGLE,6X,7HHEADING)                                             00006090
      IFLAG=52                                                                 00006100
   13 READ (4)ARRAY                                                            00006110
      PRINT 1007,ARRAY(1),(ARRAY(J),J=7,12)                                    00006120
 1007 FORMAT(F8.4,   D19.8,7X,D16.7,5X,D16.7,D23.12,4X,D12.6,4X,D12.6)        00006130
   11 IFLAG=IFLAG-1                                                            00006140
      PRINT 1010                                                               00006150
 1010 FORMAT(53X,13HEND OF OUTPUT)                                             00006160
      RETURN                                                                   00006170
      END                                                                      00006180
```

```
      SUBROUTINE CONVER                                                 0000 6190
      DOUBLE PRECISION CS,SS,XS,YS,ZS,SRS,DSPS,RS,RSD,XNUM1,XNUM2,XNUM3 0000 6200
      DOUBLE PRECISION COST,COSL,SINT,SINL,EX,Y,Z,EXD,YD,ZD,XDP,YDP,ZDP 0000 6210
      DOUBLE PRECISION TWOPI,EF,F,REQ,BK2,BK3,BK4,AK,W2,W3,W4,W5,FT,FT2 0000 6220
      DOUBLE PRECISION XNUM,XMUM,S1K,W9,S2K,S3K,S1K2,S2K2,DPS,E,W6,W7   0000 6230
      DOUBLE PRECISION XNLM,ED,SIG,W14,W15,SIGD,RSDD,SIGDD,EDD          0000 6240
      DOUBLE PRECISION ARRAY,SC1,SC2,T,H,XYZ,RSL,PZ,R,W,P,Q             0000 6250
      DOUBLE PRECISION X,XD,XDD                                         0000 6260
       DOUBLE PRECISION  AH,ACTAG1,  ACTAG2, ACTAG3                     0000 6270
      DOUBLE PRECISION EL,ELD,ELDD                                      0000 6280
      DOUBLE PRECISION TN,STN,TM                                        0000 6290
      DOUBLE PRECISION ARRAY1                                           0000 6300
      DOUBLE PRECISION PI,HALFPI,TIHAPI,ARSIN,COSLT,GNJM,GDEM,BETA,GAM  0000 6310
      DOUBLE PRECISION AH,XPUM,VPRIME,GNUM2,COSB                        0000 6320
       DOUBLE PRECISION ELIM                                            0000 6330
       COMMON/COEL/E_IM                                                 0000 6340
      COMMON ISW                                                        0000 6350
      COMMON/PARAM/ARRAY(20),MAX1,MAX2,SC1,SC2,ARRAY1(20)               0000 6360
      COMMON/TS/T,H,XYZ,RSL,PZ                                          0000 6370
      COMMON/BS/X(3),XD(3),XDD(3)                                       0000 6380
      COMMON/AX/TM,M                                                    0000 6390
       COMMON/SW1/KZ                                                    0000 6400
       COMMON/CONV/AH                                                   0000 6410
       COMMON/CON/IK,JK                                                 0000 6420
      COST=DCOS(X(2))                                                   0000 6430
      COSL=DCOS(X(3))                                                   0000 6440
      EF=57.295779513 8232.876798155                                    0000 6450
      F=0.0D0                                                           0000 6460
      REQ=20926640.0D0                                                  0000 6470
      BK2=3.3726 18220-3                                                0000 6480
      BK3=5.687349290-6                                                 0000 6490
      BK4=1.26 515570-8                                                 0000 6500
      AK =0.01745329251994329576923?                                    0000 6510
      PI = 3.14159265358979323846264338?0                               0000 6520
      HALFPI = PI/2.0D0                                                 0000 6530
      TIHAPI = 1.5D0*PI                                                 0000 6540
      TWOPI = 2.0D0*PI                                                  0000 6550
      SINT=DSIN(X(2))                                                   0000 6560
      SINL=DSIN(X(3))                                                   0000 6570
      EX   =X(1)*COST*COSL                                              0000 6580
      Y    =-X(1)*COST*SINL                                             0000 6590
      Z    =X(1)*SINT                                                   0000 6600
      EXD  =XD(1)*COST*COSL-X(1)*XD(2)*SINT*COSL-X(1)*XD(3)*COST*SINL   0000 6610
      YD   =-XD(1)*COST*SINL+X(1)*XD(2)*SINT*SINL-X(1)*XD(3)*COST*COSL  0000 6620
      ZD   =XD(1)*SINT+X(1)*XD(2)*COST                                  0000 6630
      XDP=(XDD(1)-X(1)*(XD(2)*XD(2))-X(1)*(XD(3)*XD(3)))*COST*COSL      0000 6640
     1    -(2.0D0*XD(1)*XD(2)+X(1)*XDD(2))*SINT*COSL                    0000 6650
     2    -(2.0D0*XD(1)*XD(3)+X(1)*XDD(3))*COST*SINL                    0000 6660
     3     +2.0D0*X(1)*XD(2)*XD(3)*SINT*SINL                            0000 6670
      YDP=-(XDD(1)-X(1)*(XD(2)*XD(2))-X(1)*(XD(3)*XD(3)))*COST*SINL     0000 6680
     1    +(2.0D0*XD(1)*XD(2)+X(1)*XDD(2))*SINT*SINL                    0000 6690
     2    -(X(1)*XDD(3)+2.0D0*XD(1)*XD(3))*COST*COSL                    0000 6700
```

```
     3      +2.0D0*X(1)*XD(2)*XD(3)*SINT*COSL                          00006710
      XDP=(XDD(1)-X(1)*XD(2)*XD(2))*SINT                               00006720
     1     +(2.0D0*XD(1)*XD(2)+X(1)*XDD(2))*COST                       00006730
      W2=DSIN(SC1*AK)                                                  00006740
      W3=DCOS(SC1*AK)                                                  00006750
      W4=DSIN(SC2*AK)                                                  00006760
      W5=DCOS(SC2*AK)                                                  00006770
      FT=(1.0D0-F)**2                                                  00006780
      FT2=(2.0D0*F)-F**2                                               00006790
      CS=REQ/(DSQRT(1.0D0-FT2*W2**2))                                  00006800
      AH=(CS*FT)+AW                                                    00006810
      XS=(CS+AH)*W3*W5                                                 00006820
      YS=(CS+AH)*W3*W4                                                 00006830
      ZS=S8*W2                                                         00006840
      SRS=DSQRT(XS**2+YS**2+ZS**2)                                     00006850
      DSPS=0.0D0                                                       00006860
      S1K=-((EX-XS)*W2*W5+(Y-YS)*W2*W4-(Z-ZS)*W3)                      00006870
      W9=SC2*AK                                                        00006880
      S2K=X(1)*COST*DSIN(X(3)+W9)                                      00006890
      S3K=(EXD-XS)*W3*W5+(Y-YS)*W3*W4+(Z-ZS)*W2                        00006900
      S1K2=S1K**2                                                      00006910
      S2K2=S2K**2                                                      00006920
      S3K2=S3K**2                                                      00006930
      RS=DSQRT(S1K2+S2K2+S3K2)                                         00006940
      RSD=(EXD*(EX-XS)+YD*(Y-YS)+ZD*(Z-ZS))/RS                         00006950
      XNUM1=((EX-XS)*XS)/RS                                            00006960
      XNUM2=((Y-YS)*YS)/RS                                             00006970
      XNUM3=((Z-ZS)*ZS)/RS                                             00006980
      XNUM=(XNUM1+XNUM2+XNUM3)/SRS                                     00006990
      XMUM=(XNUM1+XNUM2+XNUM3)*RS                                      00007000
      OPS=DSQRT(S1K2+S2K2)                                             00007010
       ACTAG1= OPS/S3K                                                 00007020
      B=DATAN2(OPS,S3K)                                                00007030
      IF (M.EQ.3) GO TO 30                                             00007040
      IF(T.LT.TN) GO TO 200                                            00007050
      IF(E.LT.0.0D0.AND.ELIM.LT.90.0D0)GO TO 200                       00007060
      IF(E.LE.(ELIM*AK))GO TO 47                                       00007062
      GO TO 200                                                        00007064
   30  IF(E.LE.(ELIM*AK)) GO TO 40                                     00007070
      GO TO 200                                                        00007080
   40  IF(ISW.NE.0) GO TO 47                                           00007090
      TN = T                                                           00007100
      ISW = 1                                                          00007110
   47  EL = TWOPI/4.0D0-E                                              00007120
45    W6=DSIN(E)                                                       00007130
      W7=DCOS(E)                                                       00007140
      XNLM=XS*EXD+YS*YD+ZS*ZD                                          00007150
      EQ=(-RS*XNLM+XMUM*RSD)/(SRS*(RS**2)*DSIN(E+DSPS))                00007160
      ELD=-ED                                                          00007170
   65  ACTAG2=   S2K/S1K                                               00007180
      SIG=DATAN2(S2K,S1K)                                              00007190
      IF(SIG.GE.0.0D0) GO TO 9                                         00007200
```

```
      SIG=SIG+TWOPI                                                    00007210
90    W14=DSIN(SIG)                                                    00007220
      W15=DCOS(SIG)                                                    00007230
      IF(DABS(W14).GE.1.0D-16.AND.W6.GT.0.0D0)GO TO 105                00007240
100   SIGD=0.0D0                                                       00007250
      GO TO 110                                                        00007260
  105 SIGD =(EXD*W2*W5 + YD*W2*W4-ZD*W3 + (RSD*W6+RS*ED*W7)*W15)       00007270
     1/(RS*W6*W14)                                                     00007280
110   XPUM1=(XS/SRS)*(XDP/RS)                                          00007290
      XPUM2=(YS/SRS)*(YDP/RS)                                          00007300
      XPUM3=(ZS/SRS)*(ZDP/RS)                                          00007310
      XPUM=(XPUM1+XPUM2+XPUM3)/(DSIN(E+DSPS))                          00007320
      RSDD=(((EX-XS)*XDP+(Y-YS)*YDP+(Z-ZS)*ZDP)                        00007330
     1      +(EXD*EXD+YD*YD+ZD*ZD-RSD*RSD))/RS                         00007340
      EDD=-XPUM+((XNUM/DSIN(E+DSPS))*(RSDD/RS))-(ED*ED*(DCOS(E+DSPS)   00007350
     1      /DSIN(E+DSPS)))-(2.0D0*ED*(RSD/RS))                        00007360
      ELDD=-EDD                                                        00007370
      IF(DABS(W14).GE.1.0D-16.AND.W6.GT.0.0D0)GO TO 108                00007380
      SIGDD=0.0D0                                                      00007390
      GO TO 109                                                        00007400
108   SIGDD=(XDP*W2*W5+YDP*W2*W4-ZDP*W3-2.0D0*RSD*W6*W14*SIGD          00007410
     1      -2.0D0*RS*W7*W14*ED*SIGD-2.0D0*RS*W6*W15*SIGD*SIGD         00007420
     2      +2.0D0*RSD*W7*W15*ED+RSDD*W6*W15+RS*EDD*W7*W15)/(RS*W6*W14) 00007430
109   SIGD= SIGD*EF                                                    00007440
      EL=EL*EF                                                         00007450
      ELD=ELD*EF/0.6D2                                                 00007460
      ELDD=ELDD*EF/3.36D4                                              00007470
      SIG=SIG*EF                                                       00007480
      SIGDD=SIGDD*EF                                                   00007490
      ARRAY(1)=T                                                       00007500
      ARRAY(2) = RS                                                    00007510
      ARRAY(3) = RSD/0.6D2                                             00007520
      ARRAY(4)=RSDD/0.36D4                                             00007530
      ARRAY(5)=SIG                                                     00007540
      ARRAY(6)=SIGD/0.6D2                                              00007550
      ARRAY(7)=SIGDD/ .36D4                                            00007560
      ARRAY(8)=EL                                                      00007570
      ARRAY(9)=ELD                                                     00007580
      ARRAY(10)=ELDD                                                   00007590
C      CALCULATION OF HEADING  ANGLE(CLOCKWISE 0 TO 2PI)               00007600
      COSLT = XD(3)*COST/XD(2)                                         00007610
      IF (XD(2)) 1,2,3                                                 00007620
C      ZERO XD(2)                                                      00007630
    2 IF (COSLT) 4,5,6                                                 00007640
C      NEGATIVE COSLT                                                  00007650
    4 BETA = TIHAPI                                                    00007660
      GO TO 60                                                         00007670
C      ZERO COSLT                                                      00007680
    5 BETA = 1.0D1*PI                                                  00007690
      GO TO 60                                                         00007700
C      POSITIVE COSLT                                                  00007710
    6 BETA = HALFPI                                                    00007720
```

```
      GO TO 60                                                          00007730
C      NEGATIVE XD(2)                                                   00007740
    1 IF (COSLT) 9,8,9                                                 00007750
C      NEGATIVE OR POSITIVE COSLT                                       00007760
    9 BETA = PI + DATAN(COSLT)                                         00007770
      GO TO 60                                                         00007780
C      ZERO COSLT                                                       00007790
    8 BETA = PI                                                        00007800
      GO TO 60                                                         00007810
C      POSITIVE XD(2)                                                   00007820
    3 IF (COSLT) 10,11,12                                              00007830
C      NEGATIVE COSLT                                                   00007840
   10 BETA = TWOPI + DATAN(COSLT)                                      00007850
      GO TO 60                                                         00007860
C      ZERO COSLT                                                       00007870
   11 BETA = 0.00D0                                                    00007880
      GO TO 60                                                         00007890
C      POSITIVE COSLT                                                   00007900
   12 BETA = DATAN(COSLT)                                              00007910
C      CALCULATION OF RE/ENTRY ANGLE(CLOCKWISE 0 TO 2PI)                00007920
   60 GNUM = X(1)*XD(2)                                                00007930
      COSB = DCOS(BETA)                                                00007940
      GDEM = XD(1)*COSB                                                00007950
      IF(GDEM) 13,14,15                                                00007960
C      ZERO GDEM                                                        00007970
   14 IF (GNUM) 16,17,18                                               00007980
C      NEGATIVE GNUM                                                    00007990
   16 ARSIN = TIHAPI                                                   00008000
      GO TO 62                                                         00008010
C      ZERO GNUM                                                        00008020
   17 ARSIN = 1.0D1*PI                                                 00008030
      GO TO 62                                                         00008040
C      POSITIVE GNUM                                                    00008050
   18 ARSIN = HALFPI                                                   00008060
      GO TO 62                                                         00008070
C      NEGATIVE GDEM                                                    00008080
   13 IF (GNUM) 19,20,19                                               00008090
C      NEGATIVE OR POSITIVE GNUM                                        00008100
   19 ACTAG3 = GNUM/GDEM                                               00008110
      ARSIN = PI+DATAN(ACTAG3)                                         00008120
      GO TO 62                                                         00008130
C      ZERO GNUM                                                        00008140
   20 ARSIN = PI                                                       00008150
      GO TO 62                                                         00008160
C      POSITIVE GDEM                                                    00008170
   15 IF (GNUM) 21,22,23                                               00008180
C      NEGATIVE GNUM                                                    00008190
   21 ACTAG3 = GNUM/GDEM                                               00008200
      ARSIN=TWOPI + DATAN(ACTAG3)                                      00008210
      GO TO 62                                                         00008220
C      ZERO GNUM                                                        00008230
   22 ARSIN = 0.0D0                                                    00008240
```

```
      GO TO 62                                                          0000825
C      POSITIVE GNUM                                                    0000826
   23  ACTAG3 = GNUM/GDEM                                               0000827
       ARSIN = DATAN(ACTAG3)                                            0000828
      GO TO 62                                                          0000829
  62  GAM = ARSIN                                                       0000830
      GAM = GAM*EF                                                      0000831
      ARRAY(11) = GAM                                                   0000832
      BETA = BETA*EF                                                    0000833
      ARRAY(12) = BETA                                                  0000834
       IF(KZ.NE.1) GO TO 540                                            0000835
       IF(M.EQ.1) GO TO 190                                             0000836
       GO TO 640                                                        0000837
  540  IF(M.EQ.3) GO TO 190                                             0000838
  640  CONTINUE                                                         0000839
       WRITE(07) ARRAY                                                  0000840
      GO TO 195                                                         0000841
  190 WRITE (02) ARRAY                                                  0000842
  195 CALL SAVE (-1)                                                    0000843
  200 RETURN                                                            0000844
         END                                                            0000845
```

```
6829T D1  01-06-76   10.218

      SUBROUTINE RKG(TO)                                                    00008460
      DOUBLE PRECISION C,F,D,A,B,DEG,DXN,DXDX,DL,SAD,ABLE,BAKER             00008470
      DOUBLE PRECISION X,XD,XDD                                             00008480
      DOUBLE PRECISION P,Q                                                  00008490
      DIMENSION C(4), F(4), D(4), A(3),B(3)                                 00008500
      COMMON /RS/ X(3),XD(3),XDD(3)                                         00008510
      COMMON /ST/ P(3), Q(3)                                                00008520
      DATA C/0.5D0,.2928932188,1.707106781,.1666666667/                     00008530
      DATA D/0.5D0,.2928932188,1.707106781,0.5D0/                           00008540
      DATA F/2.0D0,1.0D0,1.0D0,2.0D0/                                       00008550
      DF=57.295779513 82320876798155                                        00008560
      DO 10 J=1,4                                                           00008570
      CALL EQTNX                                                            00008580
      DO 10 I=1,3                                                           00008590
      A(I)=XD(I)                                                            00008600
      B(I)=XDD(I)                                                           00008610
      DXN =(A(I)+F(J)*Q(I))*C(J)                                            00008620
      DXDX = (B(I) + F(J) * P(I)) * C(J)                                    00008630
      DL=TO*DXN                                                             00008640
      X(I)=X(I)+DL                                                          00008650
      XD(I)=XD(I)+TO*DXDX                                                   00008660
      Q(I)=Q(I)+3.0D0*DXN-D(J)*A(I)                                         00008670
10    P(I)=P(I)+3.0D0*DXDX-D(J)*B(I)                                        00008680
      SAD=X(3)-6.283185307179586476925287                                   00008690
      IF ( SAD ) 12,11,11                                                   00008700
 11   X(3) = SAD                                                            00008710
12    RETURN                                                                00008720
      END                                                                   00008730
```

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      SUBROUTINE INPUTT                                                 00008740
       COMMON/SW1/KZ                                                    00008750
      COMMON/AX/TM,MT                                                   00008760
      COMMON/IC/CA,BETA,GAM,HX,GLAM,THE,GLAMI,THEI                      00008770
      COMMON/IC2/VO,INERTL                                              00008780
      COMMON/IC3/TMI                                                    00008790
     */PARAM/ARRAY(20),MAX1,MAX2,SC1,SC2,ARRAY1(20)                     00008800
      COMMON/THS/T,H,XYZ,RSL,PZ                                         00008810
       COMMON/PTURB/A(2 ),B(20),C(2 )                                   00008820
      COMMON/CONV/AH                                                    00008830
      COMMON/NTRAJ/ MM                                                  00008840
      COMMON/EQATMO/ZK,KAT                                              00008850
       COMMON/CON/IK,JK                                                 00008860
       COMMON/CDEL/E_IM                                                 00008870
      DOUBLE PRECISION TM,CA,BETA,GAM,HX                                00008880
      DOUBLE PRECISION TMI                                              00008890
       DOUBLE PRECISION A,B,C                                           00008900
      DOUBLE PRECISION SC1,SC2,AH                                       00008910
     *,ARRAY,ARRAY1                                                     00008920
      DOUBLE PRECISION T,H,XYZ,RSL,PZ                                   00008930
      DOUBLE PRECISION ZK                                               00008940
      DOUBLE PRECISION GLAM,THE,GLAMI,THEI                              00008950
      DOUBLE PRECISION VO                                               00008960
       DOUBLE PRECISION ELIM,EELIM                                      00008970
       IK = 0                                                           00008980
       JK = 10                                                          00008990
      NAMELIST/IN1/TM,TMI                                               00009000
      NAMELIST/IN2/CA,BETA,GAM,HX                                       00009010
       NAMELIST/IN3/KZ                                                  00009020
      NAMELIST/IN4/ELIM                                                 00009030
     */IN5/VO,INERTL                                                    00009040
      NAMELIST/IN6/ZK,KAT                                               00009050
C                  KAT = 1  CALL ATMOSPHERE                             00009060
C                  KAT = 0  SET ATMOSPHERIC DENSITY = 0                 00009070
      NAMELIST/IN7/A,B,C,MM                                             00009080
C        MM EQUAL 3 GIVES NOMINAL TRAJECTORY                            00009090
C        MM GREATER THAN 3 GIVES MM-3 PERTURBED TRAJECTORIES            00009100
      NAMELIST/IN8/SC1,SC2,AH                                           00009110
      NAMELIST/IN9/GLAM,THE,GLAMI,THEI                                  00009120
C               GLAM  = LAUNCH LONGITUDE **AND** THE  = LAUNCH LATITUDE 00009130
C                       IN DEGREES                                      00009140
C               GLAMI = IMPACT LONGITUDE **AND** THEI = IMPACT LATITUDE 00009150
C                       IN DEGREES                                      00009160
C               FOR SOUTH LATITUDES USE A NEGATIVE  THE  OR  THEI       00009170
C          SENSOR LONGITUDE MEASURED WEST OF GREENWICH, ALL OTHER       00009180
C            LONGITUDES ARE MEASURED WEST OF GREENWICH                  00009190
      READ(5,IN1)                                                       00009200
      IK=0                                                              00009205
      JK=0                                                              00009206
      READ(5,IN2)                                                       00009210
       READ(5,IN3)                                                      00009220
      READ(5,IN4)                                                       00009230
```

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      READ(5,IN5)                                                          00009240
      READ(5,IN6)                                                          00009250
      READ(5,IN7)                                                          00009260
      READ(5,IN8)                                                          00009270
      READ(5,IN9)                                                          00009280
      BELIM = 90.000-ELIM                                                  00009290
      WRITE(6,5)                                                           00009300
      WRITE(6,10) TM,TMI                                                   00009310
      WRITE(6,20) CA,HX                                                    00009320
      WRITE(6,30) BETA                                                     00009330
      WRITE(6,40)GAM,VO,INERTL                                             00009340
      WRITE(6,50) ZK                                                       00009350
      WRITE(6,53) KAT                                                      00009360
       WRITE(6,140) KZ                                                     00009370
      WRITE(6,54)                                                          00009380
      WRITE(6,55) MM                                                       00009390
      WRITE(6,60)                                                          00009400
      WRITE(6,70)                                                          00009410
       WRITE(6,80) (A(NN),B(NN),C(NN),NN=1,20)                             00009420
      WRITE(6,90)                                                          00009430
      WRITE(6,100)                                                         00009440
      WRITE(6,110)SC1,SC2,AH                                               00009450
      WRITE(6,120) G_AM,THE                                                00009460
      WRITE(6,130) G_AMI,THEI                                              00009470
      WRITE(6,150) BELIM                                                   00009480
    5 FORMAT(1H1,55X,"INPUTS")                                             00009490
   10 FORMAT(1H0,34H MAXIMUM RUN TIME (FORWARD)  TM = ,D16.8,4HMIN.,5X,30 00009500
     *7H     CUT-OFF TIME (BACKWARDS)  TMI = ,D16.8,"MIN.")                00009510
   20 FORMAT(1H0,21H SURFACE RANGE  CA = ,D16.8,8H DEGREES,5X,16H ALTITU  00009520
     *DE  HX = ,D16.8,5H FEET)                                             00009530
   30 FORMAT(1H0,60H MISSILE HEADING ANGLE MEASURED CLOCKWISE FROM NORTH  00009540
     *  BETA = ,D16.8,8H DEGREES)                                         00009550
   40 FORMAT(1H0,22H REENTRY ANGLE  GAM = ,D25.8,8H DEGREES,5X,24H INITI  00009560
     *AL VELOCITY  VO = ,D25.18,7H FT/MIN,                                00009570
     */50X,"INERTL = ",I3,5X,                                            00009572
     */68X,"IF INERTL = ,INITIAL VELOCITY IS BURNOUT VELOCITY",           00009574
     */68X,"IF INERTL =1,INITIAL VELOCITY IS INERTIAL VELOCITY")          00009576
   50 FORMAT(1H ,2X,5H ZK = ,D25.18,36H FT**2/SLUGS , BALLISTIC COEFFICI  00009580
     *ENT)                                                               00009590
   53 FORMAT(1H ,7H KAT = ,I2,1X,55H NO ATMOSPHERE SET KAT = 0 , FOR AT   00009600
     *MOSPHERE SET KAT = 1)                                              00009610
   54 FORMAT(1H ,56H FOR CASE OF NO ATMOSPHERE, ATMOSPHERIC DENSITY  PZ   00009620
     * = 0)                                                              00009630
   55 FORMAT(1H0,6H MM = ,I4)                                            00009640
   60 FORMAT(1H0,45X,30H PERTURBED VELOCITY COMPONENTS)                  00009650
   70 FORMAT(1H ,4X,3HH PERTURBATION TO LEFT - FT/SEC,9X,32H PERTURBATI  00009660
     *ON BACKWARDS - FT/SEC,9X,3HH PERTURBATION UPWARDS - FT/SEC)        00009670
   80 FORMAT(1H ,7X,D25.18,15X,D25.18,15X,D25.18)                        00009680
   90 FORMAT(1H0,39X,41H SENSOR'S COORDINATES IN DEGREES AND FEET)       00009690
  100 FORMAT(1H ,10X,18H GEODETIC LATITUDE,12X,38H LONGITUDE, WEST OF GR  00009700
     *EENWICH MERIDIAN,8X,25H ALTITUDE ABOVE SEA-LEVEL)                  00009710
  110 FORMAT(1H0,7X,3(D25.18,15X))                                       00009720
```

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  120 FORMAT(1H0,20H LAUNCH LONGITUDE = ,D25.18,5X,12H LATITUDE = ,D25.10000009730
     *8)                                                                  00009740
  130 FORMAT(1H0,20H IMPACT LONGITUDE = ,D25.18,5X,12H LATITUDE = ,D25.10000009750
     *8)                                                                  00009760
  140 FORMAT(1H0,1 X,5H KZ = ,I5)                                         00009770
  150 FORMAT(1H ,4X,38H LOWEST ELEVATION ANGLE PRINTED OUT = ,D12.4)      00009780
      RETURN                                                              00009790
      END                                                                 00009800
```

Listing of the Sample Input for the Program

INPUTS

MAXIMUM RUN TIME (FORWARD) TM = 0.44000000D 02MIN. CUT-OFF TIME (BACKWARDS) TMI = 0. MIN.

SURFACE RANGE CA = 0.91565100D 02 DEGREES ALTITUDE HX = 0.40000000D 06 FEET

MISSILE HEADING ANGLE MEASURED CLOCKWISE FROM NORTH BETA = 0.27800000D 03 DEGREES

REENTRY ANGLE GAM = 0.55000000D 02 DEGREES INITIAL VELOCITY VO = 0.10560000000000000D 07 FT/MIN

INERTL = 0

IF INERTL =0, INITIAL VELOCITY IS BURNOUT VELOCITY
IF INERTL =1, INITIAL VELOCITY IS INERTIAL VELOCITY

ZK = 0.32100000000000000D-01 FT**2/SLUGS , BALLISTIC COEFFICIENT
KAT = 1 NO ATMOSPHERE SET KAT = 0 , FOR ATMOSPHERE SET KAT = 1

KZ = 1
FOR CASE OF NO ATMOSPHERE, ATMOSPHERIC DENSITY RZ = 0

MM = 8

PERTURBED VELOCITY COMPONENTS

PERTURBATION TO LEFT - FT/SEC	PERTURBATION BACKWARDS - FT/SEC	PERTURBATION UPWARDS - FT/SEC
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.50000000000000000D 01
0.	0.50000000000000000D 01	0.
0.	0.35330000000000000D 01	0.35330000000000000D 01
0.	-0.35330000000000000D 01	0.35330000000000000D 01
0.50000000000000000D 01	0.	0.
0.35330000000000000D 01	0.35330000000000000D 01	0.
0.35330000000000000D 01	-0.35330000000000000D 01	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.
0.	0.	0.

SENSOR'S COORDINATES IN DEGREES AND FEET

GEODETIC LATITUDE	LONGITUDE, WEST OF GREENWICH MERIDIAN	ALTITUDE ABOVE SEA-LEVEL
0.18200000000000000D 02	0.58333334000000000D 00	0.

LAUNCH LONGITUDE = 0.27000000000000000D 02 LATITUDE = 0.42500000000000000D 02

IMPACT LONGITUDE = 0.60000000000000000D 02 LATITUDE = -0.40000000000000000D 02

LOWEST ELEVATION ANGLE PRINTED OUT = 0.5000D 00

Sample Output for the Cobra Talon Trajectory Program

TIME	RADIUS	LATITUDE	LONGITUDE	HEIGHT	VELOCITY	R(SEA LEVEL)	DENSITY
0.	0.21325640[illegible]0D 08	0.425[illegible]0D 02	0.1270000000D 03	0.4000000000D 06	0.1668343392D 05	0.2092564000D 08	0.
0.1000	0.213858[illegible]8D 08	0.4253190D 02	0.1266885[illegible]7D 03	0.4601620[illegible]80D 06	0.1657175872D 05	0.2092564000D 08	0.
0.2000	0.21445151520 08	0.4256291D 02	0.1263783240 03	0.5195114750 06	0.1646146976D 05	0.2092564000D 08	0.
0.3000	0.21503691840 08	0.4259315D 02	0.1260694250 03	0.5780518590 06	0.1635255792D 05	0.2092564000D 08	0.
0.4000	0.21561425880 08	0.4262233D 02	0.1257617880 03	0.6357868350 06	0.1624501424D 05	0.2092564000D 08	0.
0.5000	0.21618360[illegible]0D 08	0.4265077D 02	0.1254553900 03	0.6927199480 06	0.1613883072D 05	0.2092564000D 08	0.
0.6000	0.21674494720 08	0.4267837D 02	0.1251502060 03	0.7488546490 06	0.1603399920D 05	0.2092564000D 08	0.
0.7000	0.21729834240 08	0.4270516D 02	0.1248462160 03	0.8041943420 06	0.1593051248D 05	0.2092564000D 08	0.
0.8000	0.21784382[illegible]0D 08	0.4273113D 02	0.1245433950 03	0.8587423420 06	0.1582836368D 05	0.2092564000D 08	0.
0.9000	0.21838142[illegible]8D 08	0.4275632D 02	0.1242417240 03	0.9125019130 06	0.1572754624D 05	0.2092564000D 08	0.
1.0000	0.21891115160 08	0.4278072D 02	0.1239411840 03	0.9654762620 06	0.1562805424D 05	0.2092564000D 08	0.
1.1000	0.21943318480 08	0.4280434D 02	0.1236417480 03	0.1017668480 07	0.1552988208D 05	0.2092564000D 08	0.
1.2000	0.21994721600 08	0.4282720D 02	0.1233434010 03	0.1069881680 07	0.1543302464D 05	0.2092564000D 08	0.
1.3000	0.22045359720 08	0.4284932D 02	0.1230461210 03	0.1119718810 07	0.1533747696D 05	0.2092564000D 08	0.
1.4000	0.22095222720 08	0.4287069D 02	0.1227498880 03	0.1169582860 07	0.1524323456D 05	0.2092564000D 08	0.
1.5000	0.22144316800 08	0.4289132D 02	0.1224546830 03	0.1218676680 07	0.1515029392D 05	0.2092564000D 08	0.
1.6000	0.22192643200 08	0.4291124D 02	0.1221604860 03	0.1267003100 07	0.1505865088D 05	0.2092564000D 08	0.
1.7000	0.22240204800 08	0.4293045D 02	0.1218672810 03	0.1314564880 07	0.1496830256D 05	0.2092564000D 08	0.
1.8000	0.22287004800 08	0.4294895D 02	0.1215750460 03	0.1361364720 07	0.1487924592D 05	0.2092564000D 08	0.
1.9000	0.22333045120 08	0.4296675D 02	0.1212837660 03	0.1407405280 07	0.1479147824D 05	0.2092564000D 08	0.
2.0000	0.22378329280 08	0.4298387D 02	0.1209934220 03	0.1452689130 07	0.1470499760D 05	0.2092564000D 08	0.
2.1000	0.22422859880 08	0.4300031D 02	0.1207039950 03	0.1497218830 07	0.1461980208D 05	0.2092564000D 08	0.
2.2000	0.22466635680 08	0.4301609D 02	0.1204154720 03	0.1540996840 07	0.1453588992D 05	0.2092564000D 08	0.
2.3000	0.22509656[illegible]0D 08	0.4303120D 02	0.1201278280 03	0.1584025630 07	0.1445325984D 05	0.2092564000D 08	0.
2.4000	0.22551947520 08	0.4304565D 02	0.1198410540 03	0.1626307530 07	0.1437191120D 05	0.2092564000D 08	0.
2.5000	0.22593484800 08	0.4305946D 02	0.1195551310 03	0.1667844890 07	0.1429184304D 05	0.2092564000D 08	0.
2.6000	0.22634280[illegible]0D 08	0.4307263D 02	0.1192700410 03	0.1708639960 07	0.1421305504D 05	0.2092564000D 08	0.
2.7000	0.22674335[illegible]4D 08	0.4308517D 02	0.1189857710 03	0.1748695000 07	0.1413554720D 05	0.2092564000D 08	0.
2.8000	0.22713652160 08	0.4309708D 02	0.1187023040 03	0.1788012170 07	0.1405931968D 05	0.2092564000D 08	0.
2.9000	0.22752233600 08	0.4310837D 02	0.1184196220 03	0.1826593580 07	0.1398437280D 05	0.2092564000D 08	0.
3.0000	0.22790081280 08	0.4311905D 02	0.1181377130 03	0.1864441320 07	0.1391070736D 05	0.2092564000D 08	0.
3.1000	0.22827197440 08	0.4312912D 02	0.1178565610 03	0.1901557420 07	0.1383832432D 05	0.2092564000D 08	0.
3.2000	0.22863584[illegible]0D 08	0.4313859D 02	0.1175761500 03	0.1937943850 07	0.1376722464D 05	0.2092564000D 08	0.
3.3000	0.22899242560 08	0.4314747D 02	0.1172964670 03	0.1973602560 07	0.1369740992D 05	0.2092564000D 08	0.
3.4000	0.22934175360 08	0.4315575D 02	0.1170174960 03	0.2008535440 07	0.1362888144D 05	0.2092564000D 08	0.
3.5000	0.22968384320 08	0.4316345D 02	0.1167392220 03	0.2042744300 07	0.1356164128D 05	0.2092564000D 08	0.
3.6000	0.23001871[illegible]4D 08	0.4317058D 02	0.1164616330 03	0.2076230990 07	0.1349569120D 05	0.2092564000D 08	0.
3.7000	0.23034637120 08	0.4317713D 02	0.1161847130 03	0.2108997230 07	0.1343103360D 05	0.2092564000D 08	0.
3.8000	0.23066684800 08	0.4318311D 02	0.1159084510 03	0.2141044750 07	0.1336767072D 05	0.2092564000D 08	0.
3.9000	0.23098015360 08	0.4318853D 02	0.1156328300 03	0.2172375200 07	0.1330560496D 05	0.2092564000D 08	0.
4.0000	0.23128630[illegible]8D 08	0.4319338D 02	0.1153578380 03	0.2202990240 07	0.1324483904D 05	0.2092564000D 08	0.
4.1000	0.23158531520 08	0.4319769D 02	0.1150834620 03	0.2232891420 07	0.1318537600D 05	0.2092564000D 08	0.
4.2000	0.23187720320 08	0.4320144D 02	0.1148096880 03	0.2262080280 07	0.1312721840D 05	0.2092564000D 08	0.
4.3000	0.23216193[illegible]0D 08	0.4320465D 02	0.1145365040 03	0.2290558330 07	0.1307036960D 05	0.2092564000D 08	0.
4.4000	0.23243967[illegible]4D 08	0.4320731D 02	0.1142639060 03	0.2318327040 07	0.1301483280D 05	0.2092564000D 08	0.
4.5000	0.23271027840 08	0.4320944D 02	0.1139918520 03	0.2345387840 07	0.1296061104D 05	0.2092564000D 08	0.
4.6000	0.23297382[illegible]8D 08	0.4321103D 02	0.1137203600 03	0.2371742080 07	0.1290770880D 05	0.2092564000D 08	0.
4.7000	0.23323031[illegible]4D 08	0.4321210D 02	0.1134494060 03	0.2397391070 07	0.1285612704D 05	0.2092564000D 08	0.
4.8000	0.23347975320 08	0.4321263D 02	0.1131789790 03	0.2422336190 07	0.1280587184D 05	0.2092564000D 08	0.
4.9000	0.23372213560 08	0.4321264D 02	0.1129090650 03	0.2446578650 07	0.1275694576D 05	0.2092564000D 08	0.
5.0000	0.23395759680 08	0.4321213D 02	0.1126396540 03	0.2470119680 07	0.1270935264D 05	0.2092564000D 08	0.
5.1000	0.23418630320 08	0.4321110D 02	0.1123707320 03	0.2492960440 07	0.1266309632D 05	0.2092564000D 08	0.

TIME	RADIUS	LATITUDE	LONGITUDE	HEIGHT	VELOCITY	R(SEA LEVEL)	DENSITY
5.2000	0.23440742 8D 08	0.432 956D 02	0.1121022291D 03	0.2515102111D 07	0.1261818032D 05	0.2092564000D 08	0.
5.3000	0.2346218592D 08	0.432 751D 02	0.1118343113D 03	0.2536545790 07	0.1257460864D 05	0.2092564000D 08	0.
5.4000	0.2348293248D 08	0.432 495D 02	0.1115667922D 03	0.2557292570 07	0.1253238496D 05	0.2092564000D 08	0.
5.5000	0.2350298336D 08	0.432 188D 02	0.1112997130 03	0.2577343420 07	0.1249151312D 05	0.2092564000D 08	0.
5.6000	0.2352233952D 08	0.4319831D 02	0.1110330670 03	0.2596699420 07	0.1245199696D 05	0.2092564000D 08	0.
5.7000	0.2354100160D 08	0.4319424D 02	0.1107668400 03	0.2615361470 07	0.1241384016D 05	0.2092564000D 08	0.
5.8000	0.2355897056D 08	0.4318967D 02	0.1105010220 03	0.2633330520 07	0.1237704640D 05	0.2092564000D 08	0.
5.9000	0.2357624736D 08	0.4318460D 02	0.1102356030 03	0.2650607420 07	0.1234161968D 05	0.2092564000D 08	0.
6.0000	0.2359283296D 08	0.43179 3D 02	0.1099705710 03	0.2667193080 07	0.1230756336D 05	0.2092564000D 08	0.
6.1000	0.2360872832D 08	0.4317298D 02	0.1097059130 03	0.2683088320 07	0.1227488128D 05	0.2092564000D 08	0.
6.2000	0.2362393376D 08	0.4316643D 02	0.1094416220 03	0.2698293850 07	0.1224357696D 05	0.2092564000D 08	0.
6.3000	0.2363845056D 08	0.431594 0D 02	0.1091776830 03	0.2712810460 07	0.1221365376D 05	0.2092564000D 08	0.
6.4000	0.2365227? 4D 08	0.4315187D 02	0.1089140880 03	0.2726638880 07	0.1218511504D 05	0.2092564000D 08	0.
6.5000	0.2366541984D 08	0.4314386D 02	0.1086508250 03	0.2739779740 07	0.1215796432D 05	0.2092564000D 08	0.
6.6000	0.2367787360D 08	0.4313537D 02	0.1083878840 03	0.2752233760 07	0.1213220448D 05	0.2092564000D 08	0.
6.7000	0.2368964160 D 08	0.4312639D 02	0.1081252540 03	0.2764001440 07	0.1210783872D 05	0.2092564000D 08	0.
6.8000	0.2370072352D 08	0.4311693D 02	0.1078629240 03	0.2775083450 07	0.1208487024D 05	0.2092564000D 08	0.
6.9000	0.2371112032D 08	0.4310700D 02	0.1076008840 03	0.2785480250 07	0.1206330144D 05	0.2092564000D 08	0.
7.0000	0.2372083232D 08	0.4309658D 02	0.1073391250 03	0.2795192410 07	0.1204313536D 05	0.2092564000D 08	0.
7.1000	0.2372986048D 08	0.4308568D 02	0.1070776340 03	0.2804220380 07	0.1202437440D 05	0.2092564000D 08	0.
7.2000	0.2373821448D 08	0.4307430D 02	0.1068164030 03	0.2812564600 07	0.1200702096D 05	0.2092564000D 08	0.
7.3000	0.2374586560D 08	0.4306245D 02	0.1065554200 03	0.2820225470 07	0.1199107744D 05	0.2092564000D 08	0.
7.4000	0.2375284352D 08	0.4305012D 02	0.1062946750 03	0.2827203360 07	0.1197654576D 05	0.2092564000D 08	0.
7.5000	0.2375913856D 08	0.4303731D 02	0.1060341580 03	0.2833498620 07	0.1196342784D 05	0.2092564000D 08	0.
7.6000	0.2376475168D 08	0.4302403D 02	0.1057738600 03	0.2839111520 07	0.1195172544D 05	0.2092564000D 08	0.
7.7000	0.2376968224D 08	0.4301027D 02	0.1055137690 03	0.2844042360 07	0.1194144032D 05	0.2092564000D 08	0.
7.8000	0.2377393152D 08	0.4299604D 02	0.1052538760 03	0.2848291390 07	0.1193257360D 05	0.2092564000D 08	0.
7.9000	0.2377749888D 08	0.4298133D 02	0.1049941710 03	0.2851858780 07	0.1192512672D 05	0.2092564000D 08	0.
8.0000	0.2378038464D 08	0.4296615D 02	0.1047346440 03	0.2854744730 07	0.1191910048D 05	0.2092564000D 08	0.
8.1000	0.2378258944D 08	0.4295050D 02	0.1044752840 03	0.2856949400 07	0.1191449584D 05	0.2092564000D 08	0.
8.2000	0.2378411296D 08	0.4293436D 02	0.1042160820 03	0.2858472830 07	0.1191131344D 05	0.2092564000D 08	0.
8.3000	0.2378495552D 08	0.4291776D 02	0.1039570280 03	0.2859315130 07	0.1190955376D 05	0.2092564000D 08	0.
8.4000	0.2378511648D 08	0.429 068D 02	0.1036981110 03	0.2859476380 07	0.1190921696D 05	0.2092564000D 08	0.
8.5000	0.2378459648D 08	0.4288312D 02	0.1034393220 03	0.2858956510 07	0.1191030304D 05	0.2092564000D 08	0.
8.6000	0.2378339552D 08	0.42865 8D 02	0.1031806510 03	0.2857755550 07	0.1191281184D 05	0.2092564000D 08	0.
8.7000	0.2378151328D 08	0.4284657D 02	0.1029220880 03	0.2855873440 07	0.1191674320D 05	0.2092564000D 08	0.
8.8000	0.2377895 8D 08	0.4282758D 02	0.1026636240 03	0.2853310040 07	0.1192209648D 05	0.2092564000D 08	0.
8.9000	0.237757 528D 08	0.428 811D 02	0.1024052470 03	0.2850065310 07	0.1192887088D 05	0.2092564000D 08	0.
9.0000	0.2377177088D 08	0.4278817D 02	0.1021469480 03	0.2846139000 07	0.1193706560D 05	0.2092564000D 08	0.
9.1000	0.2376717088D 08	0.4276774D 02	0.1018887180 03	0.2841531000 07	0.1194667936D 05	0.2092564000D 08	0.
9.2000	0.2376188096D 08	0.4274683D 02	0.1016305470 03	0.2836241020 07	0.1195771088D 05	0.2092564000D 08	0.
9.3000	0.237559 88 0D 08	0.4272544D 02	0.1013724240 03	0.2830268860 07	0.1197015888D 05	0.2092564000D 08	0.
9.4000	0.23749254 8D 08	0.427 356D 02	0.1011143400 03	0.2823614200 07	0.1198402144D 05	0.2092564000D 08	0.
9.5000	0.2374191680D 08	0.4268120D 02	0.1008562840 03	0.2816276730 07	0.1199929680D 05	0.2092564000D 08	0.
9.6000	0.2373389 60D 08	0.4265835D 02	0.1005982480 03	0.2808256090 07	0.1201598304D 05	0.2092564000D 08	0.
9.7000	0.2372519 20D 08	0.4263501D 02	0.1003402200 03	0.2799551900 07	0.1203407792D 05	0.2092564000D 08	0.
9.8000	0.237158 384D 08	0.4261119D 02	0.1000821910 03	0.2790163710 07	0.1205357904D 05	0.2092564000D 08	0.
9.9000	0.2370573120D 08	0.4258687D 02	0.9982415100 02	0.2780091100 07	0.1207448400D 05	0.2092564000D 08	0.
10.0000	0.2369497344D 08	0.4256216D 02	0.9956608890 02	0.2769335560 07	0.1209679024D 05	0.2092564000D 08	0.
10.1000	0.2368353056D 08	0.4253675D 02	0.9930799740 02	0.2757890560 07	0.1212049472D 05	0.2092564000D 08	0.
10.2000	0.236714 160D 08	0.4251095D 02	0.9904986360 02	0.2745761560 07	0.1214559488D 05	0.2092564000D 08	0.
10.3000	0.2365858592D 08	0.4248464D 02	0.9879167870 02	0.2732945980 07	0.1217208752D 05	0.2092564000D 08	0.

TIME	RADIUS	LATITUDE	LONGITUDE	HEIGHT	VELOCITY	R(SEA LEVEL)	DENSITY
10,4000	0.23645083 D 08	0.4245784D 02	0,9853343 23D 02	0.271944316D 07	0.1219996960D 05	0.20925640 00D 08	0.
10,5000	0.2363 89248D 08	0.4243053D 02	0,982751142D 02	0.270525244D 07	0.1222923776D 05	0.20925640 00D 08	0.
10,6000	0.23616 1312D 08	0.424 271D 02	0,9801167155D 02	0.269037315D 07	0.1225988864D 05	0.20925640 00D 08	0.
10,7000	0.23600 4448D 08	0.4237438D 02	0,9775822333D 02	0.267480457D 07	0.1229191888D 05	0.20925640 00D 08	0.
10,8000	0.23584 8592D 08	0.4234554D 02	0,9749962888D 02	0.265854558D 07	0.1232532496D 05	0.20925640 00D 08	0.
10,9000	0.23567 3548D 08	0.4231619D 02	0,9724092228D 02	0.264159635D 07	0.1236010336D 05	0.20925640 00D 08	0.
11,0000	0.23549 952 D 08	0.4228631D 02	0,9698209 28D 02	0.2623955 7D 07	0.1239625040D 05	0.20925640 00D 08	0.
11,1000	0.2353126112D 08	0.4225592D 02	0,9672312 96D 02	0.260562124D 07	0.1243376224D 05	0.20925640 00D 08	0.
11,2000	0.23512 3392D 08	0.42225 0D 02	0,964640217D 02	0.258659392D 07	0.1247263536D 05	0.20925640 00D 08	0.
11,3000	0.23492512 0D 08	0.4219356D 02	0,9620476 3D 02	0.256687216D 07	0.1251286576D 05	0.20925640 00D 08	0.
11,4000	0.23472 95 4D 08	0.42161 8D 02	0,959453337D 02	0.254645497D 07	0.1255444992D 05	0.20925640 00D 08	0.
11,5000	0.2345 981 44D 08	0.42129 7D 02	0,9568573 5D 02	0.252534137D 07	0.1259738400D 05	0.20925640 00D 08	0.
11,6000	0.23429 7024D 08	0.42096 2D 02	0,9542594 4D 02	0.250353030D 07	0.1264166400D 05	0.20925640 00D 08	0.
11,7000	0.2340666 8D 08	0.4206243D 02	0,9516595 32D 02	0.248102064D 07	0.1268728624D 05	0.20925640 00D 08	0.
11,8000	0.23383451 D 08	0.42028 9D 02	0,949057587D 02	0.245781129D 07	0.1273424688D 05	0.20925640 00D 08	0.
11,9000	0.2335954112D 08	0.4199361D 02	0,946453440D 02	0.243390108D 07	0.1278254224D 05	0.20925640 00D 08	0.
12,0000	0.2333492864D 08	0.4195837D 02	0,9438469 88D 02	0.240928880D 07	0.1283216864D 05	0.20925640 00D 08	0.
12,1000	0.2330961312D 08	0.4192257D 02	0,941238118D 02	0.238397318D 07	0.1288312256D 05	0.20925640 00D 08	0.
12,2000	0.2328359296D 08	0.4188621D 02	0,9386267 13D 02	0.235795302D 07	0.1293540000D 05	0.20925640 00D 08	0.
12,3000	0.2325686688D 08	0.4184928D 02	0,936012684D 02	0.233122691D 07	0.1298899792D 05	0.20925640 00D 08	0.
12,4000	0.232294336 D 08	0.4181178D 02	0,933395891D 02	0.230379353D 07	0.1304391248D 05	0.20925640 00D 08	0.
12,5000	0.23201291 52D 08	0.4177371D 02	0,930776217D 02	0.227565148D 07	0.1310014048D 05	0.20925640 00D 08	0.
12,6000	0.2317243936D 08	0.41735 5D 02	0,9281535 74D 02	0.224679932D 07	0.1315767888D 05	0.20925640 00D 08	0.
12,7000	0.2314287552D 08	0.4169581D 02	0,9255278 20D 02	0.221723558D 07	0.1321652416D 05	0.20925640 00D 08	0.
12,8000	0.2311259872D 08	0.4165597D 02	0,9228988 28D 02	0.218695872D 07	0.1327667360D 05	0.20925640 00D 08	0.
12,9000	0.230816 7 4D 08	0.4161554D 02	0,9202665 8D 02	0.215596716D 07	0.1333812432D 05	0.20925640 00D 08	0.
13,0000	0.230498992 D 08	0.4157451D 02	0,917630720D 02	0.212425934D 07	0.1340087344D 05	0.20925640 00D 08	0.
13,1000	0.2301747360D 08	0.41532860 02	0,9149913 47D 02	0.209183358D 07	0.1346491840D 05	0.20925640 00D 08	0.
13,2000	0.22984328 32D 08	0.4149060D 02	0,912348275D 02	0.205868820D 07	0.1353025680D 05	0.20925640 00D 08	0.
13,3000	0.2295046144D 08	0.4144772D 02	0,9097013 50D 02	0.2024821 47D 07	0.1359688640D 05	0.20925640 00D 08	0.
13,4000	0.2291587168D 08	0.4140422D 02	0,9070504 83D 02	0.199023160D 07	0.1366480528D 05	0.20925640 00D 08	0.
13,5000	0.2288055568D 08	0.41360 8D 02	0,9043955 07D 02	0.195491676D 07	0.1373401120D 05	0.20925640 00D 08	0.
13,6000	0.2284451328D 08	0.4131530D 02	0,901736332D 02	0.191887510D 07	0.1380450272D 05	0.20925640 00D 08	0.
13,7000	0.2280774464D 08	0.4126987D 02	0,8990728 6D 02	0.188210470D 07	0.1387627840D 05	0.20925640 00D 08	0.
13,8000	0.2277024352D 08	0.4122379D 02	0,896404787D 02	0.184460360D 07	0.1394933680D 05	0.20925640 00D 08	0.
13,9000	0.227320 992D 08	0.41177 5D 02	0,893732172D 02	0.180636979D 07	0.1402367712D 05	0.20925640 00D 08	0.
14,0000	0.2269304128D 08	0.4112964D 02	0,891054796D 02	0.176740123D 07	0.1409929840D 05	0.20925640 00D 08	0.
14,1000	0.2265333568D 08	0.4108156D 02	0,888372544D 02	0.172769580D 07	0.1417620000D 05	0.20925640 00D 08	0.
14,2000	0.226128912 D 08	0.4103279D 02	0,885685260D 02	0.168725136D 07	0.1425438192D 05	0.20925640 00D 08	0.
14,3000	0.225717 360D 08	0.4098333D 02	0,882992806D 02	0.164606571D 07	0.1433384400D 05	0.20925640 00D 08	0.
14,4000	0.2252977664D 08	0.4093317D 02	0,880295052D 02	0.160413659D 07	0.1441458864D 05	0.20925640 00D 08	0.
14,5000	0.224871 176D 08	0.4088230D 02	0,877591846D 02	0.156146171D 07	0.1449660960D 05	0.20925640 00D 08	0.
14,6000	0.2244367872D 08	0.4083072D 02	0,874883033D 02	0.151803870D 07	0.1457991456D 05	0.20925640 00D 08	0.
14,7000	0.223995 528D 08	0.4077841D 02	0,872168473D 02	0.147386518D 07	0.1466450240D 05	0.20925640 00D 08	0.
14,8000	0.22354573 6D 08	0.4072536D 02	0,869448012D 02	0.142893868D 07	0.1475037456D 05	0.20925640 00D 08	0.
14,9000	0.223088956 4D 08	0.4067157D 02	0,866721497D 02	0.138325670D 07	0.1483753248D 05	0.20925640 00D 08	0.
15,0000	0.2226245664D 08	0.4061703D 02	0,863988774D 02	0.133681667D 07	0.1492597856D 05	0.20925640 00D 08	0.
15,1000	0.22215255 0D 08	0.4056172D 02	0,861249689D 02	0.128961595D 07	0.1501571504D 05	0.20925640 00D 08	0.
15,2000	0.2216729184D 08	0.4050564D 02	0,858504064D 02	0.124165188D 07	0.1510674480D 05	0.20925640 00D 08	0.
15,3000	0.221185616 0D 08	0.4044878D 02	0,855751756D 02	0.119292174D 07	0.1519907056D 05	0.20925640 00D 08	0.
15,4000	0.22069 6272D 08	0.4039112D 02	0,852992595D 02	0.114342272D 07	0.1529269616D 05	0.20925640 00D 08	0.
15,5000	0.22018792 0D 08	0.4033265D 02	0,8502264 6D 02	0.109315195D 07	0.1538762528D 05	0.20925640 00D 08	0.

TIME	RADIUS	LATITUDE	LONGITUDE	WEIGHT	VELOCITY	R(SEA LEVEL)	DENSITY
15.6000	0.21967746560 08	0.40273370 02	0.84745301 7D 02	0.10421065 4D 07	0.15483862 24D 05	0.20925640 00D 08	0.
15.7000	0.21915923520 08	0.40213250 02	0.84467226 2D 02	0.99028352 0D 06	0.15581411 36D 05	0.20925640 00D 08	0.
15.8000	0.21863320 00D 08	0.40152300 02	0.84188396 1D 02	0.93767984 6D 06	0.15680277 76D 05	0.20925640 00D 08	0.
15.9000	0.21809932480 08	0.40090490 02	0.83908792 9D 02	0.88429244 1D 06	0.15780467 04D 05	0.20925640 00D 08	0.
16.0000	0.21755758 80 08	0.40027820 02	0.83628398 7D 02	0.83011811 2D 06	0.15881984 64D 05	0.20925640 00D 08	0.
16.1000	0.21700793 60D 08	0.39964270 02	0.83347194 8D 02	0.77515364 4D 06	0.15984837 12D 05	0.20925640 00D 08	0.
16.2000	0.21645035 84D 08	0.39899830 02	0.83065162 8D 02	0.71939575 6D 06	0.16089031 04D 05	0.20925640 00D 08	0.
16.3000	0.21588488 96D 08	0.39834480 02	0.82782282 2D 02	0.66284106 8D 06	0.16194573 60D 05	0.20925640 00D 08	0.
16.4000	0.21531125 08D 08	0.39768210 02	0.82498533 7D 02	0.60548616 3D 06	0.16301472 32D 05	0.20925640 00D 08	0.
16.5000	0.21472967 52D 08	0.39701010 02	0.82213897 6D 02	0.54732753 9D 06	0.16409735 20D 05	0.20925640 00D 08	0.
16.6000	0.21414 160D 08	0.39632860 02	0.81928353 2D 02	0.48836161 9D 06	0.16519371 04D 05	0.20925640 00D 08	0.
16.7000	0.21354224 80D 08	0.39563740 02	0.81641879 6D 02	0.42858476 1D 06	0.16630388 80D 05	0.20925640 00D 08	0.
16.8000	0.21293633 28D 08	0.39493640 02	0.81354455 6D 02	0.36799324 8D 06	0.16742798 08D 05	0.20925640 00D 08	0.
16.9000	0.21232223 36D 08	0.39422550 02	0.81066059 5D 02	0.30658331 2D 06	0.16856565 92D 05	0.20925640 00D 08	0.26621970-08

TIME	R-DOT	LAT.-DOT	LONG.-DOT	R-DOT DOT	LAT.-DOT DOT	LONG.-DOT DOT
0.	0.100949453D 05	0.539180D-02	-0.520259D-01	-0.226787923D 02	-0.2500659D-04	0.3704917D-04
0.1000	0.9959186 3D 04	0.524197D-02	-0.518057D-01	-0.2257451 5D 02	-0.2460 2AD-04	0.3636490D-04
0.2000	0.9824 4597D 04	0.5 9552D-02	-0.515895D-01	-0.224723164D 02	-0.2421372D-04	0.3569403D-04
0.3000	0.968951449D 04	0.495138D-02	-0.513773D-01	-0.223721555D 02	-0.2383453D-04	0.3503616D-04
0.4000	0.9555577 8D 04	0.480949D-02	-0.511690D-01	-0.222739958D 02	-0.2346635D-04	0.3439088D-04
0.5000	0.942222272D 04	0.466977D-02	-0.509646D-01	-0.221778006D 02	-0.2310883D-04	0.3375783D-04
0.6000	0.928943961D 04	0.453216D-02	-0.507639D-01	-0.220835344D 02	-0.2276163D-04	0.3313664D-04
0.7000	0.915721551D 04	0.439661D-02	-0.505669D-01	-0.219911625D 02	-0.2242445D-04	0.3252695D-04
0.8000	0.9025541 8D 04	0.426305D-02	-0.503736D-01	-0.219006521D 02	-0.2209697D-04	0.3192843D-04
0.9000	0.88944 499D 04	0.413142D-02	-0.501838D-01	-0.218119705D 02	-0.2177890D-04	0.3134073D-04
1.0000	0.876379468D 04	0.400168D-02	-0.499975D-01	-0.217250857D 02	-0.2146995D-04	0.3076355D-04
1.1000	0.86337 048D 04	0.387377D-02	-0.498146D-01	-0.216399676D 02	-0.2116986D-04	0.3019657D-04
1.2000	0.850411161D 04	0.374763D-02	-0.496351D-01	-0.215565862D 02	-0.2087837D-04	0.2963949D-04
1.3000	0.8375 1798D 04	0.362321D-02	-0.494589D-01	-0.214749123D 02	-0.2059522D-04	0.2909204D-04
1.4000	0.82464 934D 04	0.350 47D-02	-0.492860D-01	-0.213949182D 02	-0.2032017D-04	0.2855392D-04
1.5000	0.811827564D 04	0.337935D-02	-0.491162D-01	-0.213165764D 02	-0.2005300D-04	0.2802487D-04
1.6000	0.799061716D 04	0.325982D-02	-0.489496D-01	-0.212398604D 02	-0.1979347D-04	0.2750462D-04
1.7000	0.786339411D 04	0.314182D-02	-0.487862D-01	-0.211647443D 02	-0.1954138D-04	0.2699293D-04
1.8000	0.7736627 7D 04	0.302531D-02	-0.486257D-01	-0.210912030D 02	-0.1929652D-04	0.2648954D-04
1.9000	0.761029557D 04	0.291024D-02	-0.484683D-01	-0.210192123D 02	-0.1905869D-04	0.2599422D-04
2.0000	0.748439347D 04	0.279659D-02	-0.483138D-01	-0.209487486D 02	-0.1882770D-04	0.2550674D-04
2.1000	0.73589 860D 04	0.268430D-02	-0.481622D-01	-0.208797886D 02	-0.1860337D-04	0.2502688D-04
2.2000	0.7233833 8D 04	0.257333D-02	-0.480134D-01	-0.208123102D 02	-0.1838553D-04	0.2455441D-04
2.3000	0.710915795D 04	0.246366D-02	-0.478675D-01	-0.207462916D 02	-0.1817399D-04	0.2408912D-04
2.4000	0.698487468D 04	0.235523D-02	-0.477244D-01	-0.206817120D 02	-0.1796860D-04	0.2363082D-04
2.5000	0.686097459D 04	0.224802D-02	-0.475839D-01	-0.206185504D 02	-0.1776920D-04	0.2317930D-04
2.6000	0.673744928D 04	0.214199D-02	-0.474462D-01	-0.205567873D 02	-0.1757565D-04	0.2273437D-04
2.7000	0.661429143D 04	0.203710D-02	-0.473111D-01	-0.204964032D 02	-0.1738778D-04	0.2229585D-04
2.8000	0.649148972D 04	0.193333D-02	-0.471786D-01	-0.204373793D 02	-0.1720547D-04	0.2186354D-04
2.9000	0.636903916D 04	0.183063D-02	-0.470487D-01	-0.203796976D 02	-0.1702858D-04	0.2143728D-04
3.0000	0.624693068D 04	0.172897D-02	-0.469214D-01	-0.203233401D 02	-0.1685698D-04	0.2101689D-04
3.1000	0.612515648D 04	0.162833D-02	-0.467965D-01	-0.202682899D 02	-0.1669054D-04	0.2060220D-04
3.2000	0.600373867D 04	0.152868D-02	-0.466741D-01	-0.202145300D 02	-0.1652915D-04	0.2019305D-04
3.3000	0.588257958D 04	0.142997D-02	-0.465542D-01	-0.201620444D 02	-0.1637268D-04	0.1978929D-04
3.4000	0.576176160D 04	0.133220D-02	-0.464366D-01	-0.201108174D 02	-0.1622102D-04	0.1939075D-04
3.5000	0.564124729D 04	0.123531D-02	-0.463215D-01	-0.200608336D 02	-0.1607409D-04	0.1899729D-04
3.6000	0.552102918D 04	0.113930D-02	-0.462087D-01	-0.200120784D 02	-0.1593174D-04	0.1860876D-04
3.7000	0.540109990D 04	0.104412D-02	-0.460982D-01	-0.199645371D 02	-0.1579390D-04	0.1822502D-04
3.8000	0.528145228D 04	0.949762D-03	-0.459900D-01	-0.199181961D 02	-0.1566047D-04	0.1784593D-04
3.9000	0.516207716D 04	0.856188D-03	-0.458840D-01	-0.198730417D 02	-0.1553135D-04	0.1747135D-04
4.0000	0.504297344D 04	0.763377D-03	-0.457803D-01	-0.198290611D 02	-0.1540647D-04	0.1710114D-04
4.1000	0.492412812D 04	0.671303D-03	-0.456788D-01	-0.197862412D 02	-0.1528572D-04	0.1673519D-04
4.2000	0.480553525D 04	0.579940D-03	-0.455795D-01	-0.197445700D 02	-0.1516904D-04	0.1637337D-04
4.3000	0.4687191 4D 04	0.489266D-03	-0.454823D-01	-0.197040356D 02	-0.1505633D-04	0.1601554D-04
4.4000	0.456908556D 04	0.399257D-03	-0.453873D-01	-0.196646264D 02	-0.1494753D-04	0.1566159D-04
4.5000	0.445121331D 04	0.309888D-03	-0.452944D-01	-0.196263313D 02	-0.1484256D-04	0.1531140D-04
4.6000	0.433356742D 04	0.221138D-03	-0.452035D-01	-0.195891393D 02	-0.1474135D-04	0.1496486D-04
4.7000	0.421614144D 04	0.132985D-03	-0.451148D-01	-0.195530404D 02	-0.1464383D-04	0.1462186D-04
4.8000	0.409892375D 04	0.454 51D-04	-0.450281D-01	-0.195180241D 02	-0.1454995D-04	0.1428227D-04
4.9000	0.398192300D 04	-0.4162190-04	-0.449434D-01	-0.194840809D 02	-0.1445962D-04	0.1394600D-04
5.0000	0.386511766D 04	-0.128117D-03	-0.448607D-01	-0.194512014D 02	-0.1437281D-04	0.1361294D-04
5.1000	0.37485 646D 04	-0.214102D-03	-0.447800D-01	-0.194193764D 02	-0.1428945D-04	0.1328299D-04

TIME	R-DOT	LAT.-DOT	LONG.-DOT	R-DOT DOT	LAT.-DOT DOT	LONG.-DOT DOT
5.2000	0.3632083 7D 04	-0.299598D-03	=0,447013D-01	-0.1938859740 02	-0.1420948D-04	0.1295604D-04
5.3000	0.351584121D 04	-0.384623D-03	=0,446245D-01	-0.193588556D 02	-0.1413285D-04	0.1263199D-04
5.4000	0.3399774750 04	-0.469198D-03	=0,445497D-01	-0.193301433D 02	-0.1405952D-04	0.1231075D-04
5.5000	0.3288387747D 04	-0.553344D-03	=0,444768D-01	-0.193024526D 02	-0.1398943D-04	0.1199221D-04
5.6000	0.3168143290 04	-0.637178D-03	=0,444056D-01	-0.192757758D 02	-0.1392253D-04	0.1167630D-04
5.7000	0.3052565140 04	-0.720420D-03	=0,443367D-01	-0.192501057D 02	-0.1385880D-04	0.1136290D-04
5.8000	0.2937149 3D 04	-0.8 3390D-03	=0,442694D-01	-0.192254358D 02	-0.1379817D-04	0.1105194D-04
5.9000	0.2821858940 04	-0.886 04D-03	=0,442040D-01	-0.192017590D 02	-0.1374062D-04	0.1074332D-04
6.0000	0.2706715960 04	-0.968283D-03	=0,441405D-01	-0.191790692D 02	-0.1368610D-04	0.1043695D-04
6.1000	0.25917 8160 04	-0.105 24D-02	=0,440788D-01	-0.1915736040 02	-0.1363458D-04	0.1013275D-04
6.2000	0.2476825650 04	-0.113190D-02	=0,440189D-01	-0.191366267D 02	-0.1358603D-04	0.9830630D-05
6.3000	0.2362065680 04	-0.121328D-02	=0,439608D-01	-0.191168627D 02	-0.1354041D-04	0.9530509D-05
6.4000	0.22474224 0D 04	-0.129439D-02	=0,439045D-01	-0.190980632D 02	-0.1349769D-04	0.9232302D-05
6.5000	0.2132888 10 04	-0.137526D-02	=0,438500D-01	-0.190802230D 02	-0.1345785D-04	0.8935928D-05
6.6000	0.20184578 0D 04	-0.145589D-02	=0,437973D-01	-0.190633376D 02	-0.1342085D-04	0.8641305D-05
6.7000	0.1904125 60 04	-0.153632D-02	=0,437463D-01	-0.190474025D 02	-0.1338667D-04	0.8348355D-05
6.8000	0.1789887 8D 04	-0.161654D-02	=0,436971D-01	-0.190324137D 02	-0.1335529D-04	0.8056998D-05
6.9000	0.1675733210 04	-0.169658D-02	=0,436497D-01	-0.190183670D 02	-0.1332668D-04	0.7767156D-05
7.0000	0.1561664810 04	-0.177647D-02	=0,436039D-01	-0.190052590D 02	-0.1330083D-04	0.7478752D-05
7.1000	0.1447670240 04	-0.185620D-02	=0,435599D-01	-0.189930860D 02	-0.1327772D-04	0.7191711D-05
7.2000	0.1333745920 04	-0.19358 0D-02	=0,435176D-01	-0.189818451D 02	-0.1325732D-04	0.6905957D-05
7.3000	0.1219885240 04	-0.2 1529D-02	=0,434770D-01	-0.189715332D 02	-0.1323963D-04	0.6621414D-05
7.4000	0.1106085660 04	-0.2 9468D-02	=0,434382D-01	-0.189621476D 02	-0.1322462D-04	0.6338009D-05
7.5000	0.992338524D 03	-0.217399D-02	=0,434010D-01	-0.189536860D 02	-0.1321229D-04	0.6055669D-05
7.6000	0.878639390D 03	-0.225324D-02	=0,433655D-01	-0.1894614620 02	-0.1320262D-04	0.5774320D-05
7.7000	0.7649830330 03	-0.233243D-02	=0,433317D-01	-0.1893952620 02	-0.1319561D-04	0.5493891D-05
7.8000	0.651363443D 03	-0.241159D-02	=0,432996D-01	-0.1893382430 02	-0.1319124D-04	0.5214308D-05
7.9000	0.5377753 8D 03	-0.249 73D-02	=0,432691D-01	-0.189290390D 02	-0.1318951D-04	0.4935501D-05
8.0000	0.4242131450 03	-0.256987D-02	=0,432403D-01	-0.189251689D 02	-0.1319041D-04	0.4657399D-05
8.1000	0.3106714560 03	-0.264902D-02	=0,432132D-01	-0.189222134D 02	-0.1319394D-04	0.4379930D-05
8.2000	0.197144760D 03	-0.272820D-02	=0,431878D-01	-0.189201715D 02	-0.1320009D-04	0.4103023D-05
8.3000	0.83627575 0D 02	-0.280743D-02	=0,431640D-01	-0.189190427D 02	-0.1320887D-04	0.3826610D-05
8.4000	-0.298855747D 02	-0.288671D-02	=0,431418D-01	-0.189188265D 02	-0.1322028D-04	0.3550619D-05
8.5000	-0.14340 166D 03	-0.296608D-02	=0,431214D-01	-0.189195232D 02	-0.1323431D-04	0.3274981D-05
8.6000	-0.256921576D 03	-0.3 4553D-02	=0,431025D-01	-0.189211328D 02	-0.1325097D-04	0.2999625D-05
8.7000	-0.3704555840 03	-0.3125 9D-02	=0,430854D-01	-0.189236558D 02	-0.1327026D-04	0.2724482D-05
8.8000	-0.484007372D 03	-0.320478D-02	=0,430699D-01	-0.189270928D 02	-0.1329220D-04	0.2449481D-05
8.9000	-0.5975825210 03	-0.3284 0D-02	=0,430560D-01	-0.189314446D 02	-0.1331677D-04	0.2174554D-05
9.0000	-0.711186534D 03	-0.336459D-02	=0,430438D-01	-0.1893671230 02	-0.1334401D-04	0.1899630D-05
9.1000	-0.8248249 2D 03	-0.344474D-02	=0,430332D-01	-0.189428976D 02	-0.1337391D-04	0.1624639D-05
9.2000	-0.938503142D 03	-0.3525 8D-02	=0,430243D-01	-0.1895000170 02	-0.1340648D-04	0.1349511D-05
9.3000	-0.1052225760 04	-0.360562D-02	=0,430170D-01	-0.189580265D 02	-0.1344175D-04	0.1074174D-05
9.4000	-0.11660 131D 04	-0.368638D-02	=0,430114D-01	-0.189669744D 02	-0.1347972D-04	0.7985597D-06
9.5000	-0.12798323 0D 04	-0.376738D-02	=0,430074D-01	-0.189768473D 02	-0.1352041D-04	0.5225954D-06
9.6000	-0.1393725320 04	-0.384863D-02	=0,430051D-01	-0.189876481D 02	-0.1356383D-04	0.2462102D-06
9.7000	-0.1507685950 04	-0.393 15D-02	=0,430045D-01	-0.189993795D 02	-0.1361002D-04	-0.3066772D-07
9.8000	-0.1621719740 04	-0.4 1196D-02	=0,430055D-01	-0.190120444D 02	-0.1365898D-04	-0.3081107D-06
9.9000	-0.1735832350 04	-0.409407D-02	=0,430082D-01	-0.190256462D 02	-0.1371074D-04	-0.5861914D-06
10.0000	-0.1850029370 04	-0.417650D-02	=0,430125D-01	-0.1904018860 02	-0.1376532D-04	-0.8649833D-06
10.1000	-0.196431549D 04	-0.425926D-02	=0,430185D-01	-0.190556752D 02	-0.1382275D-04	-0.1144560D-05
10.2000	-0.2078699370 04	-0.434237D-02	=0,430262D-01	-0.190721100D 02	-0.1388305D-04	-0.1424996D-05
10.3000	-0.219318371D 04	-0.442586D-02	=0,430356D-01	-0.1908949760 02	-0.1394626D-04	-0.1706368D-05

TIME	R-DOT	LAT.-DOT	LONG.-DOT	R-DOT DOT	LAT.-DOT DOT	LONG.-DOT DOT
10,4000	-0.2307775260 04	-0.450973D-02	-0,430467D-01	-0.1910784220 02	-0.1401240D-04	-0,1988750D-05
10,5000	-0.2422479740 04	-0,459402D-02	-0,430595D-01	-0.1912714910 02	-0.1408151D-04	-0,2272219D-05
10,6000	-0.2537302970 04	-0.467872D-02	-0,430740D-01	-0.1914742300 02	-0.1415562D-04	-0,2556854D-05
10,7000	-0.2652259750 04	-0.476386D-02	-0,430902D-01	-0.1916866940 02	-0.1422876D-04	-0,2842733D-05
10,8000	-0.2767328960 04	-0,484947D-02	-0,431081D-01	-0.1919089400 02	-0,1430697D-04	-0,3129936D-05
10,9000	-0.2882543450 04	-0.493555D-02	-0,431278D-01	-0.1921410280 02	-0.1438829D-04	-0,3418542D-05
11,0000	-0.2997900190 04	-0.502214D-02	-0,431491D-01	-0.1923830170 02	-0,1447277D-04	-0,3708635D-05
11,1000	-0.3113459180 04	-0.510923D-02	-0,431723D-01	-0.1926349740 02	-0.1456044D-04	-0,4000296D-05
11,2000	-0.3229064150 04	-0.519687D-02	-0,431971D-01	-0.1928969680 02	-0.1465135D-04	-0,4293610D-05
11,3000	-0.3344883450 04	-0.528506D-02	-0,432238D-01	-0.1931690650 02	-0.1474555D-04	-0,4588662D-05
11,4000	-0.3460869150 04	-0.537382D-02	-0,432522D-01	-0.1934513420 02	-0,1484309D-04	-0,4885538D-05
11,5000	-0.3577027100 04	-0.546318D-02	-0,432824D-01	-0.1937438760 02	-0.1494401D-04	-0,5184328D-05
11,6000	-0.3693363770 04	-0.555316D-02	-0,433144D-01	-0.1940467450 02	-0.1504838D-04	-0,5485121D-05
11,7000	-0.3809885280 04	-0.564377D-02	-0,433482D-01	-0.1943600330 02	-0.1515624D-04	-0.5788007D-05
11,8000	-0.3926597920 04	-0.573504D-02	-0,433839D-01	-0.1946838240 02	-0.1526766D-04	-0,6093079D-05
11,9000	-0.4043508300 04	-0.582699D-02	-0,434214D-01	-0.1950182080 02	-0.1538270D-04	-0.6400433D-05
12,0000	-0.4160621880 04	-0,591964D-02	-0,434607D-01	-0.1953632780 02	-0,1550141D-04	-0,6710164D-05
12,1000	-0.4277945 80 04	-0,601301D-02	-0,435019D-01	-0.1957191310 02	-0.1562387D-04	-0,7022371D-05
12,2000	-0.4395487 40 04	-0,610713D-02	-0,435450D-01	-0.1960858620 02	-0.1575015D-04	-0,7337154D-05
12,3000	-0.4513251320 04	-0,620202D-02	-0,435899D-01	-0.1964635770 02	-0,1588030D-04	-0,7654614D-05
12,4000	-0.4631245560 04	-0,629770D-02	-0,436368D-01	-0.1968523820 02	-0,1601442D-04	-0,7974857D-05
12,5000	-0.4749475410 04	-0,639420D-02	-0,436856D-01	-0.1972523840 02	-0,1615256D-04	-0,8297989D-05
12,6000	-0.4867950650 04	-0,649154D-02	-0,437364D-01	-0.1976637000 02	-0.1629483D-04	-0,8624119D-05
12,7000	-0.4986675130 04	-0,658975D-02	-0,437891D-01	-0.1980864440 02	-0.1644128D-04	-0,8953357D-05
12,8000	-0.5105655700 04	-0,668885D-02	-0,438439D-01	-0.1985207400 02	-0.1659203D-04	-0,9285819D-05
12,9000	-0.5224 233D 04	-0,678886D-02	-0,439006D-01	-0.1989667120 02	-0.1674714D-04	-0.9621620D-05
13,0000	-0.5344419130 04	-0,688982D-02	-0,439593D-01	-0.1994244860 02	-0.1690671D-04	-0.9960879D-05
13,1000	-0.5464214140 04	-0,699175D-02	-0,440201D-01	-0.1998941980 02	-0.1707085D-04	-0.1030372D-04
13,2000	-0.5584629590 04	-0,709468D-02	-0,440830D-01	-0.2003759850 02	-0.1723964D-04	-0.1065027D-04
13,3000	-0.5704667710 04	-0,719864D-02	-0,441479D-01	-0.2008699900 02	-0.1741320D-04	-0.1100065D-04
13,4000	-0.5825340990 04	-0,730365D-02	-0,442150D-01	-0.2013763550 02	-0.1759163D-04	-0.1135499D-04
13,5000	-0.5946321850 04	-0,740975D-02	-0,442842D-01	-0.2018952330 02	-0.1777504D-04	-0.1171344D-04
13,6000	-0.6067617850 04	-0,751696D-02	-0,443556D-01	-0.2024267790 02	-0.1796354D-04	-0.1207612D-04
13,7000	-0.6189235540 04	-0,762532D-02	-0,444291D-01	-0.2029711520 02	-0.1815726D-04	-0.1244319D-04
13,8000	-0.6311185790 04	-0,773486D-02	-0,445049D-01	-0.2035285160 02	-0.1835632D-04	-0.1281478D-04
13,9000	-0.6433473400 04	-0,784561D-02	-0,445829D-01	-0.2040990430 02	-0.1856085D-04	-0.1319105D-04
14,0000	-0.6556103730 04	-0,795760D-02	-0,446632D-01	-0.2046829040 02	-0.1877099D-04	-0.1357215D-04
14,1000	-0.6679095610 04	-0,807087D-02	-0,447458D-01	-0.2052802810 02	-0.1898686D-04	-0.1395824D-04
14,2000	-0.6802445400 04	-0,818545D-02	-0,448307D-01	-0.2058913610 02	-0.1920862D-04	-0.1434948D-04
14,3000	-0.6926168 00 04	-0,830138D-02	-0,449180D-01	-0.2065163310 02	-0.1943642D-04	-0.1474604D-04
14,4000	-0.7050268 30 04	-0,841870D-02	-0,450077D-01	-0.2071553880 02	-0.1967041D-04	-0.1514810D-04
14,5000	-0.7174757310 04	-0,853744D-02	-0,450998D-01	-0.2078087360 02	-0.1991075D-04	-0.1555582D-04
14,6000	-0.7299642170 04	-0,865764D-02	-0,451943D-01	-0.2084765820 02	-0.2015760D-04	-0.1596939D-04
14,7000	-0.7424932160 04	-0,877935D-02	-0,452914D-01	-0.2091591400 02	-0.2041115D-04	-0.1638901D-04
14,8000	-0.7550635160 04	-0,890259D-02	-0,453910D-01	-0.2098566300 02	-0.2067157D-04	-0.1681486D-04
14,9000	-0.7676763130 04	-0,902742D-02	-0,454932D-01	-0.2105692780 02	-0.2093905D-04	-0.1724714D-04
15,0000	-0.7803323360 04	-0,915387D-02	-0,455980D-01	-0.2112973200 02	-0.2121378D-04	-0.1768607D-04
15,1000	-0.7930323170 04	-0,928200D-02	-0,457055D-01	-0.2120409950 02	-0.2149597D-04	-0.1813185D-04
15,2000	-0.8057777420 04	-0,941184D-02	-0,458156D-01	-0.2128005480 02	-0.2178582D-04	-0.1858471D-04
15,3000	-0.8185685910 04	-0,954345D-02	-0,459285D-01	-0.2135762360 02	-0.2208355D-04	-0.1904487D-04
15,4000	-0.8314069500 04	-0,967686D-02	-0,460442D-01	-0.2143683210 02	-0.2238939D-04	-0.1951256D-04
15,5000	-0.8442932220 04	-0,981214D-02	-0,461627D-01	-0.2151770720 02	-0.2270357D-04	-0.1998804D-04

TIME	R-DOT	LAT.-DOT	LONG.-DOT	R-DOT DOT	LAT.-DOT DOT	LONG.-DOT DOT
15,6000	-0.857228537D 04	-0.994932D-02	-0.462840D-01	-0.216002768D 02	-0.2302634D-04	-0.2047154D-04
15,7000	-0.870213900D 04	-0.100885D-01	-0.464083D-01	-0.216845689D 02	-0.2335795D-04	-0.2096333D-04
15,8000	-0.883253368D 04	-0.102296D-01	-0.465356D-01	-0.217706134D 02	-0.2369866D-04	-0.2146368D-04
15,9000	-0.896338995D 04	-0.103729D-01	-0.466659D-01	-0.218584406D 02	-0.2404875D-04	-0.2197286D-04
16,0000	-0.909488857D 04	-0.105182D-01	-0.467993D-01	-0.219480812D 02	-0.2440850D-04	-0.2249116D-04
16,1000	-0.922677056D 04	-0.106658D-01	-0.469358D-01	-0.220395676D 02	-0.2477821D-04	-0.2301888D-04
16,2000	-0.935928716D 04	-0.108156D-01	-0.470755D-01	-0.221329328D 02	-0.2515820D-04	-0.2355632D-04
16,3000	-0.949236966D 04	-0.109677D-01	-0.472185D-01	-0.222282102D 02	-0.2554877D-04	-0.2410380D-04
16,4000	-0.962602956D 04	-0.111222D-01	-0.473648D-01	-0.223254355D 02	-0.2595027D-04	-0.2466166D-04
16,5000	-0.976027878D 04	-0.112791D-01	-0.475145D-01	-0.224246441D 02	-0.2636305D-04	-0.2523022D-04
16,6000	-0.989512934D 04	-0.114386D-01	-0.476676D-01	-0.225258736D 02	-0.2678747D-04	-0.2580986D-04
16,7000	-0.100305934D 05	-0.116006D-01	-0.478242D-01	-0.226291619D 02	-0.2722390D-04	-0.2640094D-04
16,8000	-0.101666935D 05	-0.117653D-01	-0.479844D-01	-0.227345481D 02	-0.2767274D-04	-0.2700383D-04
16,9000	-0.103033887D 05	-0.119327D-01	-0.481482D-01	-0.228256438D 02	-0.2811518D-04	-0.2753514D-04

SENSOR-LATITUDE 18.20000 LONGITUDE(W), 0.58333

TIME(MIN)	SLANT RANGE(FT)	SL RANGE RATE(FT/SEC)	SL RANGE RDOT(FT/SEC/SEC)	AZIMUTH(DEG)	AZ RATE(DEG/SEC)
5.8 00	0.105819 36522D 08	- .371149781160D 04	0.479566974306D 01	0.181852303D 02	-0.64926D-01
5.9 00	0.105597207546D 08	- .368283959920D 04	0.475759556434D 01	0.179947579D 02	-0.65231D-01
6.0 00	0.105377 91397D 08	- .365440047135D 04	0.472261844687D 01	0.174024561D 02	-0.65536D-01
6.1 00	0.105158675483D 08	- .362616190127D 04	0.469075993040D 01	0.170063241D 02	-0.65841D-01
6.2 00	0.104941948338D 08	- .359810577176D 04	0.466204194135D 01	0.166123614D 02	-0.66146D-01
6.3 00	0.104726899623D 08	- .357 211 7292D 04	0.463648679379D 01	0.162145684D 02	-0.66451D-01
6.4 00	0.10451352 138D 08	- .354246 859780 04	0.461411718961D 01	0.158149459D 02	-0.66756D-01
6.5 00	0.1043 18011832D 08	- .351483525001D 04	0.459495621811D 01	0.154134951D 02	-0.67061D-01
6.6 00	0.104 917378 7D 08	- .348731492157D 04	0.457902735475D 01	0.150102180D 02	-0.67365D-01
6.7 00	0.10388332233 0D 08	- .345988 410 42D 04	0.456635445904D 01	0.146051171D 02	-0.67669D-01
6.8 00	0.10367655 838D 08	- .343251210827D 04	0.455696177170D 01	0.141981954D 02	-0.67972D-01
6.9 00	0.1034714199520 08	- .340519 260 12D 04	0.455087391069D 01	0.137894567D 02	-0.68274D-01
7.0 00	0.103267927483D 08	- .337789496230D 04	0.454811586655D 01	0.133789051D 02	-0.68576D-01
7.1 00	0.103 66 72431D 08	- .335 606160000D 04	0.454871299639D 01	0.129665457D 02	-0.68877D-01
7.2 00	0.102865855 21D 08	- .3323303645 7D 04	0.455269101697D 01	0.125523837D 02	-0.69177D-01
7.3 00	0.102667276579D 08	- .329596705448D 04	0.456007599668D 01	0.121364255D 02	-0.69476D-01
7.4 00	0.10247034 769D 08	- .326857586708D 04	0.457089436613D 01	0.117186776D 02	-0.69773D-01
7.5 00	0.102275 49 84D 08	- .324110940274D 04	0.458517280771D 01	0.112991476D 02	-0.70070D-01
7.6 00	0.102 81408867D 08	- .321354681966D 04	0.460293844349D 01	0.108778434D 02	-0.70365D-01
7.7 00	0.101889425812D 08	- .318586711295D 04	0.462421862225D 01	0.104547736D 02	-0.70658D-01
7.8 00	0.101699107583D 08	- .315804911243D 04	0.464904100446D 01	0.100299477D 02	-0.70950D-01
7.9 00	0.101511 4631150 08	- .313 07148123D 04	0.467743352622D 01	0.960337555D 01	-0.71240D-01
8.0 00	0.101323502633D 08	- .310191271403D 04	0.470942438137D 01	0.917506786D 01	-0.71529D-01
8.1 00	0.101138237551D 08	- .3 7355113571D 04	0.474502 0219D 01	0.874503591D 01	-0.71815D-01
8.2 00	0.10 25468 994D 08	- .3 4496489980D 04	0.478431 3805D 01	0.831329168D 01	-0.72099D-01
8.3 00	0.10 7728468 0D 08	- .3 1613198737D 04	0.482727233266D 01	0.787984784D 01	-0.72382D-01
8.4 00	0.10 59275 537D 08	- .298703020589D 04	0.487394289923D 01	0.744471770D 01	-0.72661D-01
8.5 00	0.10 414409 3D 08	- .295763718839D 04	0.492435589408D 01	0.7007915270 01	-0.72939D-01
8.6 00	0.10 83784 352D 08	- .292793 39244D 04	0.497854058764D 01	0.656945523D 01	-0.73214D-01
8.7 00	0.10 63 54 90D 08	- .2897887 9987D 04	0.503652833435D 01	0.612935295D 01	-0.73486D-01
8.8 00	0.998 1 1 916D 07	- .286748441616D 04	0.509834253966D 01	0.568782447D 01	-0.73756D-01
8.9 00	0.997189736139D 07	- .283669927026D 04	0.516401862529D 01	0.524428651D 01	-0.74023D-01
9.0 00	0.995497 529790 07	- .280550841473D 04	0.523358399245D 01	0.479935648D 01	-0.74287D-01
9.1 00	0.993023211896D 07	- .277388842579D 04	0.530706798223D 01	0.435285244D 01	-0.74547D-01
9.2 00	0.992168477450D 07	- .274181570389D 04	0.538449983423D 01	0.390479316D 01	-0.74805D-01
9.3 00	0.99 533128391D 07	- .270926647454D 04	0.54659 864272D 01	0.345519806D 01	-0.75059D-01
9.4 00	0.9889174578 5D 07	- .267621678916D 04	0.555132331013D 01	0.300408723D 01	-0.75310D-01
9.5 00	0.987321773185D 07	- .264264252650D 04	0.564077249841D 01	0.255148142D 01	-0.75558D-01
9.6 00	0.985746396578D 07	- .260851939411D 04	0.573428457755D 01	0.209740206D 01	-0.75801D-01
9.7 00	0.984191664617D 07	- .257382293043D 04	0.583188757205D 01	0.164187122D 01	-0.76042D-01
9.8 00	0.982657928578D 07	- .253852850691D 04	0.59336 9104330 01	0.118491160D 01	-0.76278D-01
9.9 00	0.981145554985D 07	- .250261133053D 04	0.603947633567D 01	0.726546566D 00	-0.76510D-01
10.0 00	0.979654924566D 07	- .246604644692D 04	0.614951390482D 01	0.266800104D 00	-0.76738D-01
10.1 00	0.978186433847D 07	- .242880874364D 04	0.626375386376D 01	0.359805697D 03	-0.76962D-01
10.2 00	0.976740 4938 7D 07	- .239 87295377D 04	0.638221561063D 01	0.359343262D 03	-0.77182D-01
10.3 00	0.975317531 26D 07	- .235221366017D 04	0.650492582027D 01	0.358879521D 03	-0.77397D-01
10.4 00	0.973917987263D 07	- .231280530002D 04	0.663191837229D 01	0.358414501D 03	-0.77608D-01
10.5 00	0.972542319647D 07	- .227262216980D 04	0.676318627617D 01	0.357948229D 03	-0.77815D-01
10.6 00	0.971191 0 8 1D 07	- .223163843070D 04	0.689878159386D 01	0.357480732D 03	-0.78017D-01
10.7 00	0.969864518380D 07	- .218982811458D 04	0.703871536000D 01	0.357012038D 03	-0.78214D-01
10.8 00	0.968563377544D 07	- .214716513042D 04	0.718307749964D 01	0.356542176D 03	-0.78406D-01
10.9 00	0.967288 9652 0D 07	- .210362327123D 04	0.733167674352D 01	0.356071176D 03	-0.78593D-01

SENSOR-LATITUDE 18.20000 LONGITUDE(W) 0.58333

TIME(MIN)	SLANT RANGE(FT)	SL RANGE RATE(FT/SEC)	SL RANGE RDOT(FT/SEC/SEC)	AZIMUTH(DEG)	AZ RATE(DEG/SEC)
11.0 00	0.966 3921 774D 07	- .2 591762212 7D 04	0.748474054029D 01	0.355599066D 03	-0.78776D-01
11.1 00	0.9648172714 7D 07	- .2 1379756435D 04	0.764221496817D 01	0.355125877D 03	-0.78953D-01
11.2 00	0.963622845341D 07	- .196746079205D 04	0.780411464257D 01	0.354651640D 03	-0.79125D-01
11.3 00	0.962456515428D 07	- .192 139312 92D 04	0.797045262283D 01	0.354176386D 03	-0.79292D-01
11.4 00	0.961318884462D 07	- .187180646207D 04	0.814124031700D 01	0.353700147D 03	-0.79454D-01
11.5 00	0.96 0105553516D 07	- .1822435511 30D 04	0.831648738399D 01	0.353222954D 03	-0.79610D-01
11.6 00	0.959 3217 851D 07	- .177199968003D 04	0.84962 1635 71D 01	0.352744840D 03	-0.79761D-01
11.7 00	0.958 84374 59D 07	- .172347214654D 04	0.868038893615D 01	0.352265837D 03	-0.79906D-01
11.8 00	0.957 67828 15D 07	- .166782606004D 04	0.886905310058D 01	0.351785979D 03	-0.80046D-01
11.9 00	0.956 83211892D 07	- .161403455328D 04	0.906219579345D 01	0.351305299D 03	-0.80180D-01
12.0 00	0.955131221 26D 07	- .155907 075566D 04	0.925981642502D 01	0.350823832D 03	-0.80308D-01
12.1 00	0.954212556837D 07	- .150290780722D 04	0.9461912 4878D 01	0.350341610D 03	-0.80431D-01
12.2 00	0.953327976872D 07	- .144551887296D 04	0.966847297767D 01	0.349858669D 03	-0.80548D-01
12.3 00	0.952478194762D 07	- .138687715798D 04	0.98795 4 8121D 01	0.349375043D 03	-0.80659D-01
12.4 00	0.95166395 2 6D 07	- .132695592312D 04	0.10 0949816829D 02	0.348890767D 03	-0.80765D-01
12.5 00	0.95 8861 8913D 07	- .126572850134D 04	0.1031489725 87D 02	0.348405876D 03	-0.80864D-01
12.6 00	0.95 1453725 74D 07	- .120316831455D 04	0.10539233 369D 02	0.347920405D 03	-0.80958D-01
12.7 00	0.949442578799D 07	- .113924889113D 04	0.10767972 6791D 02	0.347434389D 03	-0.81046D-01
12.8 00	0.948778551 38D 07	- .1 7394388406D 04	0.11 0016 9118 46D 02	0.346947865D 03	-0.81128D-01
12.9 00	0.948154128 51D 07	- .1 0722708951D 04	0.112385639960D 02	0.346460867D 03	-0.81204D-01
13.0 00	0.947571 1561 1D 07	- .939 724661 32D 03	0.114803624091D 02	0.345973431D 03	-0.81274D-01

TIME(MIN)	AZ RDOT(DEG/SEC/SEC)	ELEVATION(DEG)	EL RATE(DEG/SEC)	EL RDOT(DEG/SEC/SEC)	REENTRY ANGLE	HEADING
5.8000	-0.23218761D-03	.6683656D 00	0.2830312D-01	-0.11195365048[illegible]D-03	0.2575250 03	0.2685740 03
5.9000	-0.24[illegible]691620-03	.8361642D 00	0.2762890D-01	-0.1127867591580-03	0.2579930 03	0.2684250 03
6.0000	-0.24956553D-03	.9999024D 00	0.2694967D-01	-0.1136247304240-03	0.2584630 03	0.2682770 03
6.1000	-0.25883531D-03	.1159550D 01	0.2626540D-01	-0.1144674919390-03	0.2589350 03	0.2681290 03
6.2000	-0.26853369D-03	.1315077D 01	0.2557605D-01	-0.1153149640400-03	0.2594090 03	0.2679810 03
6.3000	-0.27869058D-03	.1466453D 01	0.2488161D-01	-0.1161670482190-03	0.2598840 03	0.2678330 03
6.4000	-0.28934348D-03	.1613646D 01	0.2418204D-01	-0.1170236415600-03	0.2603610 03	0.2676860 03
6.5000	-0.30053296D-03	.1756627D 01	0.2347731D-01	-0.1178846215110-03	0.2608400 03	0.2675390 03
6.6000	-0.3123[illegible]433D-03	.1895363D 01	0.2276741D-01	-0.1187498584660-03	0.2613200 03	0.2673920 03
6.7000	-0.3247[illegible]824D-03	.2029825D 01	0.2205231D-01	-0.1196192048480-03	0.2618020 03	0.2672450 03
6.8000	-0.3378[illegible]156D-03	.2159981D 01	0.2133197D-01	-0.1204925028370-03	0.2622850 03	0.2670990 03
6.9000	-0.3516484[illegible]D-03	.2285798D 01	0.2060639D-01	-0.1213695770020-03	0.2627690 03	0.2669530 03
9.0000	-0.36632118D-03	.2407247D 01	0.1987553D-01	-0.1222502390310-03	0.2632540 03	0.2668070 03
7.1000	-0.3819[illegible]217D-03	.2524294D 01	0.1913938D-01	-0.1231342866390-03	0.2637400 03	0.2666610 03
7.2000	-0.39848513D-03	.2636909D 01	0.1839791D-01	-0.1240214988730-03	0.2642280 03	0.2665150 03
7.3000	-0.41617739D-03	.2745059D 01	0.1765112D-01	-0.1249116431480-03	0.2647160 03	0.2663700 03
7.4000	-0.4351[illegible]245D-03	.2848711D 01	0.1689897D-01	-0.1258044637400-03	0.2652060 03	0.2662250 03
7.5000	-0.4554[illegible]314D-03	.2947835D 01	0.1614146D-01	-0.1266996944010-03	0.2656960 03	0.2660800 03
7.6000	-0.47724548D-03	.3042398D 01	0.1537857D-01	-0.1275970505670-03	0.2661870 03	0.2659350 03
7.7000	-0.5[illegible]082369D-03	.3132367D 01	0.1461029D-01	-0.1284962271440-03	0.2666780 03	0.2657900 03
7.8000	-0.52636641D-03	.3217711D 01	0.1383661D-01	-0.1293969037230-03	0.2671700 03	0.2656450 03
7.9000	-0.5541446[illegible]D-03	.3298396D 01	0.1305752D-01	-0.1302987405140-03	0.2676630 03	0.2655010 03
8.0000	-0.58448195D-03	.3374390D 01	0.1227302D-01	-0.1312013780140-03	0.2681560 03	0.2653570 03
8.1000	-0.617768270-03	.3445661D 01	0.1148311D-01	-0.1321044403880-03	0.2686490 03	0.2652130 03
8.2000	-0.65447728D-03	.3512177D 01	0.1068777D-01	-0.1330075277260-03	0.2691430 03	0.2650690 03
8.3000	-0.69519052D-03	.3573904D 01	0.9887018D-02	-0.1339102268750-03	0.2696360 03	0.2649250 03
8.4000	-0.74062984D-03	.3630810D 01	0.9080850D-02	-0.1348120962910-03	0.2701300 03	0.2647810 03
8.5000	-0.7917[illegible]244D-03	.3682863D 01	0.8269275D-02	-0.1357126806090-03	0.2706240 03	0.2646370 03
8.6000	-0.84956446D-03	.3730031D 01	0.7452302D-02	-0.1366115010980-03	0.2711170 03	0.2644940 03
8.7000	-0.91571261D-03	.3772280D 01	0.6629942D-02	-0.1375080591200-03	0.2716110 03	0.2643500 03
8.8000	-0.99211957D-03	.3809579D 01	0.5802211D-02	-0.1384018321630-03	0.2721040 03	0.2642070 03
8.9000	-0.10814396D-02	.3841896D 01	0.4969127D-02	-0.1392922755860-03	0.2725960 03	0.2640630 03
9.0000	-0.118733[illegible]4D-02	.3869198D 01	0.4130711D-02	-0.1401788277940-03	0.2730890 03	0.2639200 03
9.1000	-0.13149773D-02	.3891454D 01	0.3286990D-02	-0.1410609009790-03	0.2735800 03	0.2637770 03
9.2000	-0.14719834D-02	.3908631D 01	0.2437991D-02	-0.1419378827280-03	0.2740720 03	0.2636340 03
9.3000	-0.16699545D-02	.3920699D 01	0.1583746D-02	-0.1428091470610-03	0.2745620 03	0.2634910 03
9.4000	-0.19275989D-02	.3927626D 01	0.7242936D-03	-0.1436740357620-03	0.2750520 03	0.2633480 03
9.5000	-0.22769571D-02	.3929380D 01	-0.1403278D-03	-0.1445318731640-03	0.2755410 03	0.2632050 03
9.6000	-0.27781251D-02	.3925932D 01	-0.1010073D-02	-0.1453819586610-03	0.2760280 03	0.2630620 03
9.7000	-0.35583437D-02	.3917249D 01	-0.1884894D-02	-0.1462235686580-03	0.2765150 03	0.2629190 03
9.8000	-0.4942206[illegible]D-02	.3903303D 01	-0.2764738D-02	-0.1470559582550-03	0.2770010 03	0.2627760 03
9.9000	-0.80765968D-02	.3884063D 01	-0.3649546D-02	-0.1478783596500-03	0.2774860 03	0.2626330 03
10.0000	-0.22032059D-01	.3859499D 01	-0.4539256D-02	-0.1486899784280-03	0.2779690 03	0.2624900 03
10.1000	0.30295169D-01	.3829582D 01	-0.5433902D-02	-0.1494900030060-03	0.2784510 03	0.2623470 03
10.2000	0.8972946[illegible]D-02	.3794283D 01	-0.6333112D-02	-0.1502775936790-03	0.2789320 03	0.2622040 03
10.3000	0.52632986D-02	.3753575D 01	-0.7237107D-02	-0.1510518958420-03	0.2794110 03	0.2620610 03
10.4000	0.37212528D-02	.3707429D 01	-0.8145706D-02	-0.1518120217080-03	0.2798890 03	0.2619180 03
10.5000	0.28759228D-02	.3655818D 01	-0.9058821D-02	-0.1525570729100-03	0.2803650 03	0.2617750 03
10.6000	0.23417411D-02	.3598714D 01	-0.9976359D-02	-0.1532861204600-03	0.2808400 03	0.2616320 03
10.7000	0.197333[illegible]8D-02	.3536093D 01	-0.1089822D-01	-0.1539982218990-03	0.2813120 03	0.2614890 03
10.8000	0.17036746D-02	.3467927D 01	-0.1182430D-01	-0.1546924069350-03	0.2817830 03	0.2613460 03
10.9000	0.14975888D-02	.3394193D 01	-0.1275449D-01	-0.1553676891400-03	0.2822520 03	0.2612020 03

TIME(MIN)	AZ RDOT(DEG/SEC/SEC)	ELEVATION(DEG)	EL RATE(DEG/SEC)	EL RDOT(DEG/SEC/SEC)	REENTRY ANGLE	HEADING
11.0000	0.13348283D-02	0.3314865D 01	-0.1368867D-01	-0.15602306285 4D-03	0.282720D 03	0.261059D 03
11.1000	0.1202919 D-02	0.3229921D 01	-0.1462673D-01	-0.156657502018D-03	0.283185D 03	0.260916D 03
11.2000	0.109375 58D-02	0.3139337D 01	-0.1556852D-01	-0.157269962783D-03	0.283648D 03	0.260772D 03
11.3000	0.1001844 0D-02	0.3043092D 01	-0.1651392D-01	-0.157859382481D-03	0.284109D 03	0.260629D 03
11.4000	0.923326 77D-03	0.2941163D 01	-0.1746278D-01	-0.158424684241D-03	0.284567D 03	0.260485D 03
11.5000	0.855417 67D-03	0.2833532D 01	-0.1841497D-01	-0.158964774252D-03	0.285024D 03	0.260341D 03
11.6000	0.796051 11D-03	0.2720177D 01	-0.1937031D-01	-0.159478544683D-03	0.285478D 03	0.260197D 03
11.7000	0.743667 94D-03	0.2601082D 01	-0.2032865D-01	-0.159964874820D-03	0.285930D 03	0.260053D 03
11.8000	0.697065 20D-03	0.2476228D 01	-0.2128983D-01	-0.160422628588D-03	0.286380D 03	0.259909D 03
11.9000	0.655301 80D-03	0.2345599D 01	-0.2225367D-01	-0.160850663280D-03	0.286827D 03	0.259765D 03
12.0000	0.617630 63D-03	0.2209179D 01	-0.2321998D-01	-0.161247825399D-03	0.287272D 03	0.259621D 03
12.1000	0.583451 09D-03	0.2066954D 01	-0.2418858D-01	-0.161612950304D-03	0.287714D 03	0.259476D 03
12.2000	0.552274 91D-03	0.1918912D 01	-0.2515927D-01	-0.161944871208D-03	0.288153D 03	0.259331D 03
12.3000	0.523701 08D-03	0.1765039D 01	-0.2613184D-01	-0.162242413457D-03	0.288590D 03	0.259186D 03
12.4000	0.497397 25D-03	0.1605326D 01	-0.2710610D-01	-0.162504403716D-03	0.289025D 03	0.259041D 03
12.5000	0.473085 65D-03	0.1439763D 01	-0.2808182D-01	-0.162729662589D-03	0.289456D 03	0.258896D 03
12.6000	0.450532 39D-03	0.1268342D 01	-0.2905878D-01	-0.162917014008D-03	0.289885D 03	0.258751D 03
12.7000	0.429539 13D-03	0.1091056D 01	-0.3003675D-01	-0.163065285455D-03	0.290312D 03	0.258605D 03
12.8000	0.409935 63D-03	0.9078993D 00	-0.3101549D-01	-0.163173308285D-03	0.290735D 03	0.258459D 03
12.9000	0.391579 62D-03	0.7186688D 00	-0.3199475D-01	-0.163239923710D-03	0.291155D 03	0.258313D 03
13.0000	0.374342 71D-03	0.5239618D 00	-0.3297428D-01	-0.163263983312D-03	0.291573D 03	0.258167D 03

END OF OUTPUT

RADAR PARAMETER DIFFERENCES(PERTURBED-NOMINAL)

K = 8

TIME MINUTES	SLANT RANGE FEET	SL RANGE RATE FEET/SEC.	SL RANGE RATE DOT FEET/SEC/SEC	AZIMUTH DEGREES	AZIMUTH RATE DEGREES/SEC
	AZIMUTH RATE DOT DEGREES/SEC/SEC	ELEVATION DEGREES	ELEVATION RATE DEGREES/SEC	ELEVATION RATE DOT DEGREES/SEC/SEC	
5.800	0.10165396160 04	0.27061306880 01	-0.47045566080-02	0.42184256000-02	0.19072652320-04
	0.27758920960-06	0.61557272320-02	0.19569238720-04	0.27687491840-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.74624455040-02			
5.900	0.10326905680 04	0.26773313600 01	-0.48954309760-02	0.43336199680-02	0.19325391360-04
	0.28778493760-06	0.62736475520-02	0.19738600000-04	0.28768874560-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.76248878720-02			
6.000	0.10486652800 04	0.26473828800 01	-0.50876209920-02	0.44503292800-02	0.19577618720-04
	0.29867011840-06	0.63926034560-02	0.19914472480-04	0.29857057600-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.77891469440-02			
6.100	0.10644568540 04	0.26162771840 01	-0.52811752960-02	0.45685501440-02	0.19829219360-04
	0.31031090880-06	0.65126343040-02	0.20096897600-04	0.30951271360-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.79552533760-02			
6.200	0.10800582720 04	0.25840059520 01	-0.54761427840-02	0.46882784000-02	0.20080073280-04
	0.32278161920-06	0.66337794560-02	0.20285912320-04	0.32054421440-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.81232373120-02			
6.300	0.10954626080 04	0.25505605760 01	-0.56725720960-02	0.48095092480-02	0.20330059040-04
	0.33616719680-06	0.67560784640-02	0.20481548320-04	0.33158260480-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.82931281920-02			
6.400	0.11106626400 04	0.25159320640 01	-0.58705117440-02	0.49322371200-02	0.20579050400-04
	0.35056280000-06	0.68795713280-02	0.20683831680-04	0.34269338880-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.84649550720-02			
6.500	0.11256513920 04	0.24801112960 01	-0.60700100480-02	0.50564556160-02	0.20826920480-04
	0.36607806720-06	0.70042977920-02	0.20892783360-04	0.35381196800-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.86387459840-02			
6.600	0.11404215840 04	0.24430887360 01	-0.62711150080-02	0.51821576960-02	0.21073536800-04
	0.38283731520-06	0.71302980480-02	0.21108418240-04	0.36496609280-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.88145282560-02			
6.700	0.11549660000 04	0.24048545920 01	-0.64738743680-02	0.53093352960-02	0.21318766080-04
	0.40098417280-06	0.72576121600-02	0.21330744800-04	0.37610901120-07	
ANGULAR SEPRATION IN RADAR BEAM = ,		0.89923287040-02			
6.800	0.11692774880 04	0.23653988480 01	-0.66783352960-02	0.54379798400-02	0.21562473280-04
	0.42168289280-06	0.73862803840-02	0.21559766400-04	0.38728631360-07	

ANGULAR SEPRATION IN RADAR BEAM = , 0.9172173312D-02

6.900 0.1183348336D 04 0.2324711072D 01 -0.6884544320D-02 0.5568081600D-02 0.2180451456D-04
0.4421251264D-06 0.7516342784D-02 0.2179547904D-04 0.3984319936D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.9354086912D-02

7.000 0.1197171376D 04 0.2282780704D 01 -0.7092547584D-02 0.5699630336D-02 0.2204475136D-04
0.4655330560D-06 0.7647839488D-02 0.2203787264D-04 0.4095352768D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.9538093824D-02

7.100 0.1210739216D 04 0.2239596832D 01 -0.7302390336D-02 0.5832614784D-02 0.2228304096D-04
0.4911655360D-06 0.7780810560D-02 0.2228692896D-04 0.4206221024D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.9724217600D-02

7.200 0.1224044160D 04 0.2195148256D 01 -0.7514116928D-02 0.5967022656D-02 0.2251923232D-04
0.5193275520D-06 0.7915295872D-02 0.2254262432D-04 0.4316624064D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.9912480512D-02

7.300 0.1237078448D 04 0.2149423584D 01 -0.7727770944D-02 0.6102841088D-02 0.2275318112D-04
0.5503787200D-06 0.8051335232D-02 0.2280492608D-04 0.4426628160D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.1010290392D-01

7.400 0.1249834496D 04 0.2102411056D 01 -0.7943394816D-02 0.6240056064D-02 0.2298473152D-04
0.5847478848D-06 0.8188968192D-02 0.2307379488D-04 0.4535553792D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.1029550872D-01

7.500 0.1262304912D 04 0.2054988800D 01 -0.8161029888D-02 0.6378652736D-02 0.2321373824D-04
0.6229454160D-06 0.8328233856D-02 0.2334918240D-04 0.4643830016D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.1049031408D-01

7.600 0.1274481184D 04 0.2004474640D 01 -0.8380715968D-02 0.6518615488D-02 0.2344003648D-04
0.6655876992D-06 0.8469171264D-02 0.2363103392D-04 0.4750954816D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.1068733872D-01

7.700 0.1286355872D 04 0.1953526064D 01 -0.8602491904D-02 0.6659927488D-02 0.2366347680D-04
0.7134208256D-06 0.8611819008D-02 0.2391928448D-04 0.4857163776D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.1088660000D-01

7.800 0.1297920816D 04 0.1901240464D 01 -0.8826394624D-02 0.6802571136D-02 0.2388389920D-04
0.7673595584D-06 0.8756215296D-02 0.2421386080D-04 0.4961760704D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.1108811440D-01

7.900 0.1309168112D 04 0.1847605024D 01 -0.9052459648D-02 0.6946527936D-02 0.2410114720D-04
0.8285285696D-06 0.8902397824D-02 0.2451468064D-04 0.5065158528D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.1129189696D-01

8.000 0.1320089200D 04 0.1792606512D 01 -0.9280720512D-02 0.7091778240D-02 0.2431505312D-04

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        0.8983304832D-06   0.9150403840D-02   0.2482165344D-04   0.5167024000D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1149796192D-01

8.100   0.1330676358D 04   0.1736231856D 01  -0.9511208960D-02   0.7238301568D-02   0.2452546496D-04
        0.9785303296D-06   0.9200269824D-02   0.2513467680D-04   0.5267019200D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1170632192D-01

8.200   0.1340921264D 04   0.1678467520D 01  -0.9743954688D-02   0.7386076480D-02   0.2473222016D-04
        0.1071373544D-05   0.9352031872D-02   0.2545364064D-04   0.5364802176D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1191698896D-01

8.300   0.1350815356D 04   0.1619299872D 01  -0.9978984832D-02   0.7535080512D-02   0.2493515424D-04
        0.1179748944D-05   0.9505725056D-02   0.2577842368D-04   0.5460954880D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1212997312D-01

8.400   0.1360349920D 04   0.1558715040D 01  -0.1021632440D-01   0.7685290368D-02   0.2513409856D-04
        0.1307437680D-05   0.9661384320D-02   0.2610889504D-04   0.5554570112D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1234528384D-01

8.500   0.1369516992D 04   0.1496699296D 01  -0.1045599592D-01   0.7836681472D-02   0.2532890336D-04
        0.1459452592D-05   0.9819042944D-02   0.2644491168D-04   0.5645664448D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1256292880D-01

8.600   0.1378307504D 04   0.1433238432D 01  -0.1069801896D-01   0.7989228608D-02   0.2551939648D-04
        0.1642561824D-05   0.9978733952D-02   0.2678632128D-04   0.5734064896D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1278291456D-01

8.700   0.1386712928D 04   0.1368318336D 01  -0.1094241024D-01   0.8142905280D-02   0.2570541984D-04
        0.1866083248D-05   0.1014048920D-01   0.2713295904D-04   0.5819965632D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1300524624D-01

8.800   0.1394724512D 04   0.1301924784D 01  -0.1118918352D-01   0.8297684352D-02   0.2588681440D-04
        0.2143144736D-05   0.1030433960D-01   0.2748464928D-04   0.5902628416D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1322992736D-01

8.900   0.1402332992D 04   0.1234043328D 01  -0.1143834912D-01   0.8453537472D-02   0.2606340992D-04
        0.2492710304D-05   0.1047031480D-01   0.2784120480D-04   0.5982053952D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1345696048D-01

9.000   0.1409529856D 04   0.1164659744D 01  -0.1168991424D-01   0.8610435456D-02   0.2623059200D-04
        0.2943022560D-05   0.1063844344D-01   0.2820242496D-04   0.6058053248D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1368634640D-01

9.100   0.1416306064D 04   0.1093759616D 01  -0.1194388192D-01   0.8768348032D-02   0.2640160448D-04
        0.3537652832D-05   0.1080875280D-01   0.2856809856D-04   0.6130433664D-07

ANGULAR SEPRATION IN RADAR BEAM = ,      0.1391808400D-01
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          .14226518330 04   0.1 21328344D 01  -0.1220025152D-01   0.8927244160D-02   0.26562874A8D-04
          .5467313920-05    0.1098126912D-01    0.2893800128D-04   0.6198813184D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1415217152D-01

 9.300    0.14285587360 04  0.947351744 0D 00  -0.1245901888D-01   0.9087091840D-02   0.26718733120-04
          0.5489112338D-05  0.1115601680D-01    0.2931189504D-04   0.6263363584D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1438860480D-01

 9.400    0.14340171520 04  0.8718153856D 00  -0.1272017472D-01   0.9247857792D-02   0.26869025920-04
          0.7179636928D-05  0.1133301920D-01    0.2968953024D-04   0.6323510336D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1462737840D-01

 9.500    0.1439017520D 04  0.7947049344D 00  -0.1298370608D-01   0.9409508608D-02   0.27013596160-04
          0.9840101888D-05  0.1151229808D-01    0.3007064320D-04   0.6379418880-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1486848544D-01

 9.600    0.1443550256D 04  0.7160061568D 00  -0.1324959456D-01   0.9572009216D-02   0.27152291200-04
          0.1439535296D-04  0.1169387328D-01    0.3045495744D-04   0.6430322944D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1511191696D-01

 9.700    0.144760624 0D 04  0.6357050880D 00  -0.1351781760D-01   0.9735324160D-02   0.27284986880-04
          0.2321506672D-04  0.1187776336D-01    0.3084218176D-04   0.6476196672D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1535766272D-01

 9.800    0.14511756960 04  0.5537877888D 00  -0.1378834704D-01   0.9899416832D-02   0.27411545600-04
          0.4401171254D-04  0.1206398480D-01    0.3123201184D-04   0.6517197248D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1560570992D-01

 9.900    0.1454248528D 04  0.4702404096D 00  -0.1406114928D-01   0.1006425008D-01   0.27531803200-04
          0.1152628944D-03  0.1225255216D-01    0.3162412928D-04   0.6552551360D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1585604496D-01

10.000    0.1456815 36D 04  0.3850494784D 00  -0.1433618560D-01   0.1022978568D-01   0.27645602240-04
          0.8264761152D-03  0.1244347824D-01    0.3201820160D-04   0.6582226688D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1610865184D-01

10.100    0.14588657440 04  0.298201792 0D 00  -0.1461341120D-01   0.1039598488D-01   0.27752991680-04
          0.1693345040-02   0.1263677376D-01    0.3241388224D-04   0.6606003456D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1636351280D-01

10.200    0.1460390336D 04  0.2 9684312 0D 00  -0.1489277520D-01   0.1056280776D-01   0.27853592960-04
          0.1412886784D-03  0.1283244736D-01    0.3281080960D-04   0.6623660992D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1662060800D-01

10.300    0.146137872 0D 04  0.1194843616D 00  -0.1517422048D-01   0.1073021440D-01   0.27947444480-04
          0.4779778944D-04  0.1303650512D-01    0.3320860832D-04   0.6635163200D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1687991600D-01
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10.400   0.1461820848D 04   0.2758965216D-01  -0.1545768352D-01   0.1089816336D-01   0.2803439840D-04
         0.2368144464D-04   0.1323095152D-01   0.3360688800D-04   0.6639731072D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1714141312D-01

10.500   0.1461706464D 04  -0.6601171648D-01  -0.1574309376D-01   0.1106661328D-01   0.2811434720D-04
         0.1396507648D-04   0.1343378800D-01   0.3400524352D-04   0.6637513920D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1740507360D-01

10.600   0.1461025216D 04  -0.1613312208D 00  -0.1603037424D-01   0.1123552144D-01   0.2818719040D-04
         0.9185584000D-05   0.1363901376D-01   0.3440325568D-04   0.6628290176D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1767086976D-01

10.700   0.1459766848D 04  -0.2583798176D 00  -0.1631944000D-01   0.1140484512D-01   0.2825282848D-04
         0.6480529152D-05   0.1384662544D-01   0.3480049024D-04   0.6611653632D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1793877168D-01

10.800   0.1457920912D 04  -0.3571679488D 00  -0.1661019952D-01   0.1157454080D-01   0.2831117248D-04
         0.4805893952D-05   0.1405661712D-01   0.3519649920D-04   0.6587385280D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1820874736D-01

10.900   0.1455477520D 04  -0.4577053568D 00  -0.1690255392D-01   0.1174456448D-01   0.2836213152D-04
         0.3699780544D-05   0.1426898016D-01   0.3559081920D-04   0.6555268160D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1848076256D-01

11.000   0.1452423184D 04  -0.5600015104D 00  -0.1719639456D-01   0.1191487136D-01   0.2840564160D-04
         0.2932466656D-05   0.1448370272D-01   0.3598297248D-04   0.6515087680D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1875478080D-01

11.100   0.1448753776D 04  -0.6640648832D 00  -0.1749160672D-01   0.1208541712D-01   0.2844162656D-04
         0.2379334016D-05   0.1470077056D-01   0.3637246752D-04   0.6466632768D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1903076352D-01

11.200   0.1444452816D 04  -0.7699032960D 00  -0.1778806720D-01   0.1225615568D-01   0.2847002304D-04
         0.1968078352D-05   0.1492016608D-01   0.3675879968D-04   0.6409696064D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1930866912D-01

11.300   0.1439511376D 04  -0.8775239168D 00  -0.1808564320D-01   0.1242704208D-01   0.2849077632D-04
         0.1654435104D-05   0.1514186880D-01   0.3714144800D-04   0.6343889344D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1958845488D-01

11.400   0.1433919040D 04  -0.9869329536D 00  -0.1838419472D-01   0.1259802976D-01   0.2850383872D-04
         0.1410092496D-05   0.1536585488D-01   0.3751988064D-04   0.6269015168D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.1987007424D-01

11.500   0.1427664576D 04  -0.1098135904D 01  -0.1868357184D-01   0.1276907264D-01   0.2850917024D-04
         0.1216268128D-05   0.1559209776D-01   0.3789355008D-04   0.6185067392D-07
```

ANGULAR SEPRATION IN RADAR BEAM = , 0.2015347936D-01

11.600 0.1420737728D 04 -0.1211137168D 01 -0.1898361680D-01 0.1294012432D-01 0.2850673824D-04
0.1060108320D-05 0.1582056688D-01 0.3826189920D-04 0.6091675904D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2043861904D-01

11.700 0.1413127360D 04 -0.1325940304D 01 -0.1928416192D-01 0.1311113792D-01 0.2849651808D-04
0.9325814272D-06 0.1605122864D-01 0.3862435520D-04 0.5988663360D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2072544032D-01

11.800 0.1404822800D 04 -0.1442547760D 01 -0.1958503088D-01 0.1328206672D-01 0.2847849472D-04
0.8271928128D-06 0.1628404624D-01 0.3898033440D-04 0.5875675648D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2101388736D-01

11.900 0.1395813216D 04 -0.1560960928D 01 -0.1988603776D-01 0.1345286432D-01 0.2845265984D-04
0.7391783424D-06 0.1651897856D-01 0.3932924288D-04 0.5752738624D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2130390128D-01

12.000 0.1386087664D 04 -0.1681180096D 01 -0.2018698800D-01 0.1362348320D-01 0.2841901472D-04
0.6649795776D-06 0.1675596192D-01 0.3967047392D-04 0.5619888256D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2159542112D-01

12.100 0.1375635408D 04 -0.1803204272D 01 -0.2048767632D-01 0.1379387680D-01 0.2837568960D-04
0.6018945600D-06 0.1699500768D-01 0.4000341184D-04 0.5476429824D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2188838336D-01

12.200 0.1364445648D 04 -0.1927031248D 01 -0.2078788992D-01 0.1396399840D-01 0.2832834048D-04
0.5478455536D-06 0.1723600480D-01 0.4032743072D-04 0.5322607616D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2218272096D-01

12.300 0.1352507488D 04 -0.2052657552D 01 -0.2108740464D-01 0.1413380128D-01 0.2827135584D-04
0.5012111680D-06 0.1747891776D-01 0.4064189568D-04 0.5157937344D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2247836512D-01

12.400 0.1339810128D 04 -0.2180078240D 01 -0.2138598800D-01 0.1430323920D-01 0.2820665088D-04
0.4607138560D-06 0.1772368720D-01 0.4094616416D-04 0.4982689984D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2277524416D-01

12.500 0.1326342944D 04 -0.2309287040D 01 -0.2168339840D-01 0.1447226592D-01 0.2813427040D-04
0.4253340320D-06 0.1797024992D-01 0.4123958624D-04 0.4796409984D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2307328256D-01

12.600 0.1312095132D 04 -0.2440276192D 01 -0.2197938400D-01 0.1464083520D-01 0.2805426752D-04
0.3942517952D-06 0.1821853920D-01 0.4152150528D-04 0.4599213568D-07

ANGULAR SEPRATION IN RADAR BEAM = , 0.2337240320D-01

12.700 0.1297056000D 04 -0.2573036288D 01 -0.2227368544D-01 0.1480890192D-01 0.2796670432D-04
0.3668008736D-06 0.1846848384D-01 0.4179126048D-04 0.4390863296D-07

```
 ANGULAR SEPRATION IN RADAR BEAM = ,       0.2367252576D-01

12.800    0.1281215200D 04  -0.2707556480D 01  -0.2256603200D-01   0.1497642064D-01   0.2787165248D-04
          0.3424360608D-06   0.1872000864D-01   0.4204818528D-04   0.4171510208D-07

 ANGULAR SEPRATION IN RADAR BEAM = ,       0.2397356672D-01

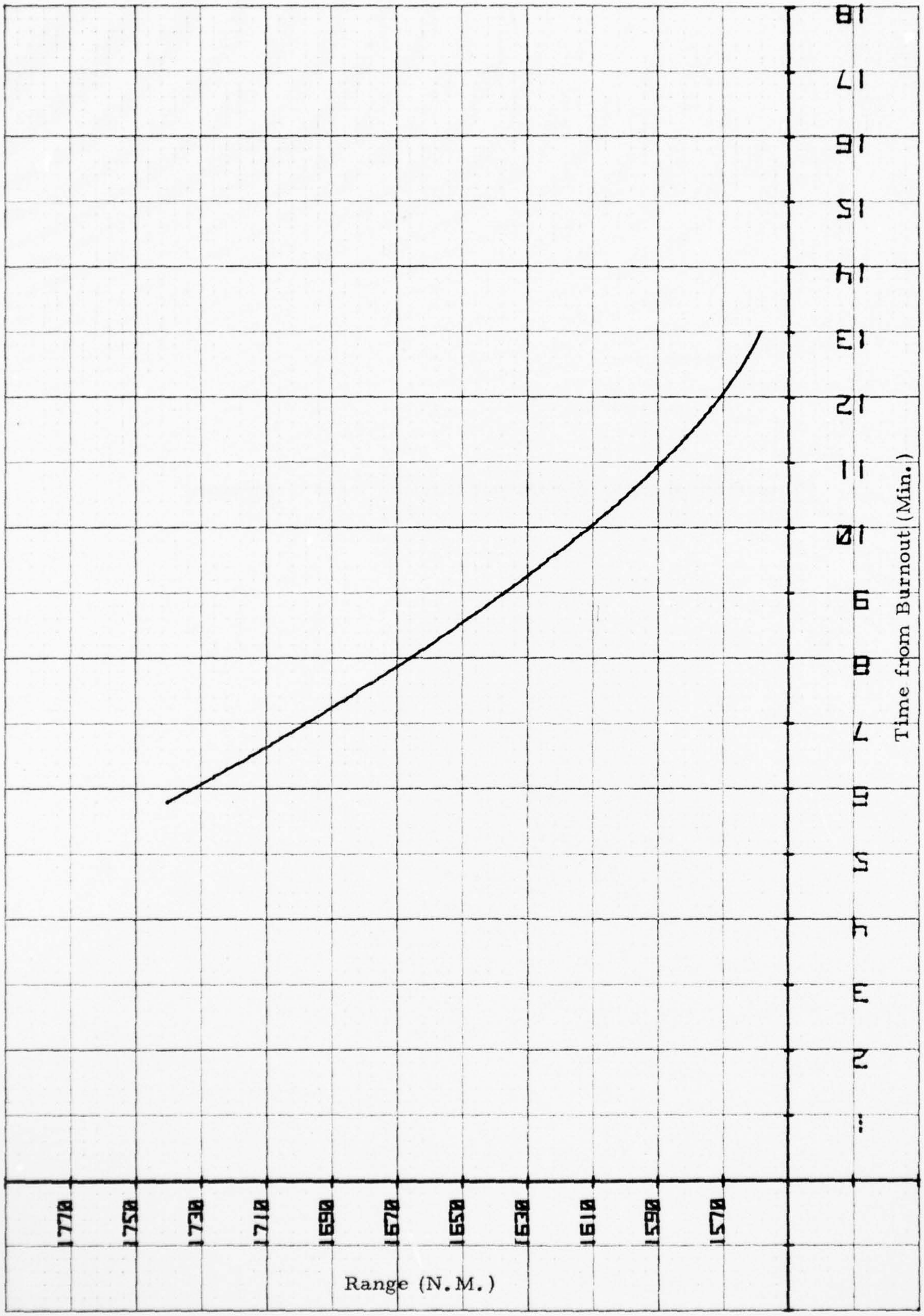
12.900    0.1264561920D 04  -0.2843824224D 01  -0.2285614688D-01   0.1514334688D-01   0.2776919104D-04
          0.3207071424D-06   0.1897303504D-01   0.4229161088D-04   0.3940768160D-07

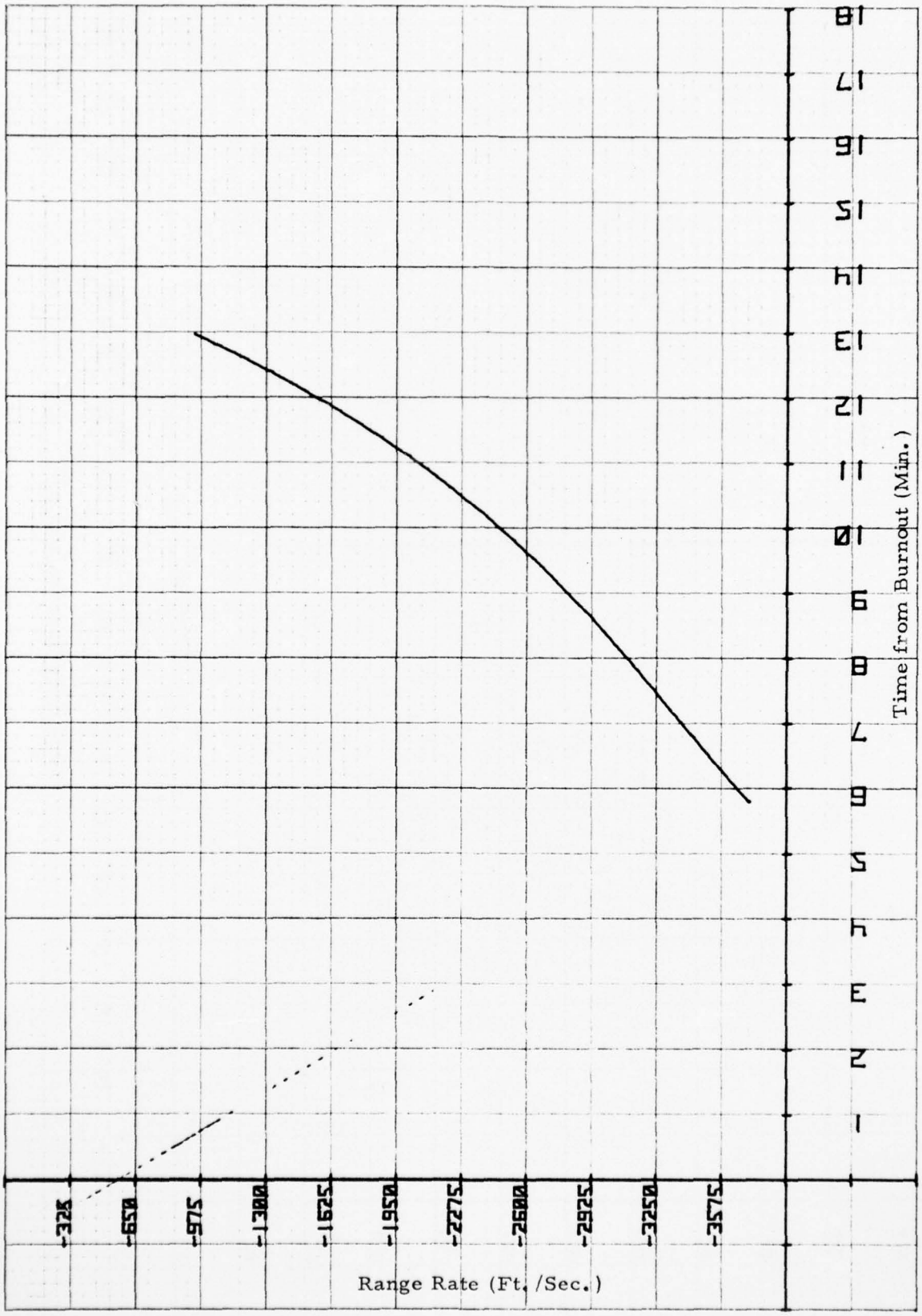
 ANGULAR SEPRATION IN RADAR BEAM = ,       0.2427544064D-01

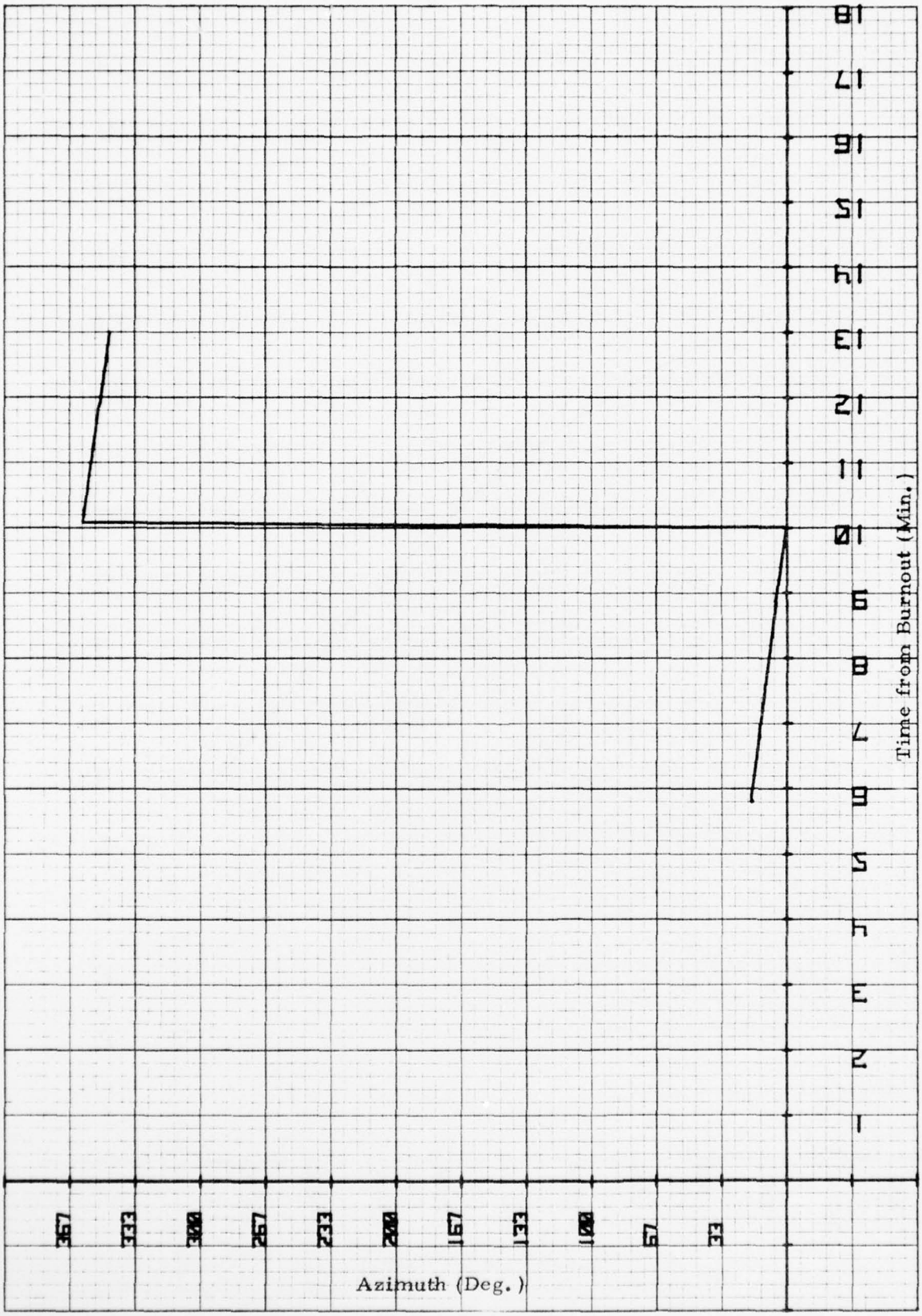
13.000    0.1247085824D 04  -0.2981825216D 01  -0.2314374304D-01   0.1530963632D-01   0.2765940928D-04
          0.3012405888D-06   0.1922747952D-01   0.4252086624D-04   0.3699197536D-07

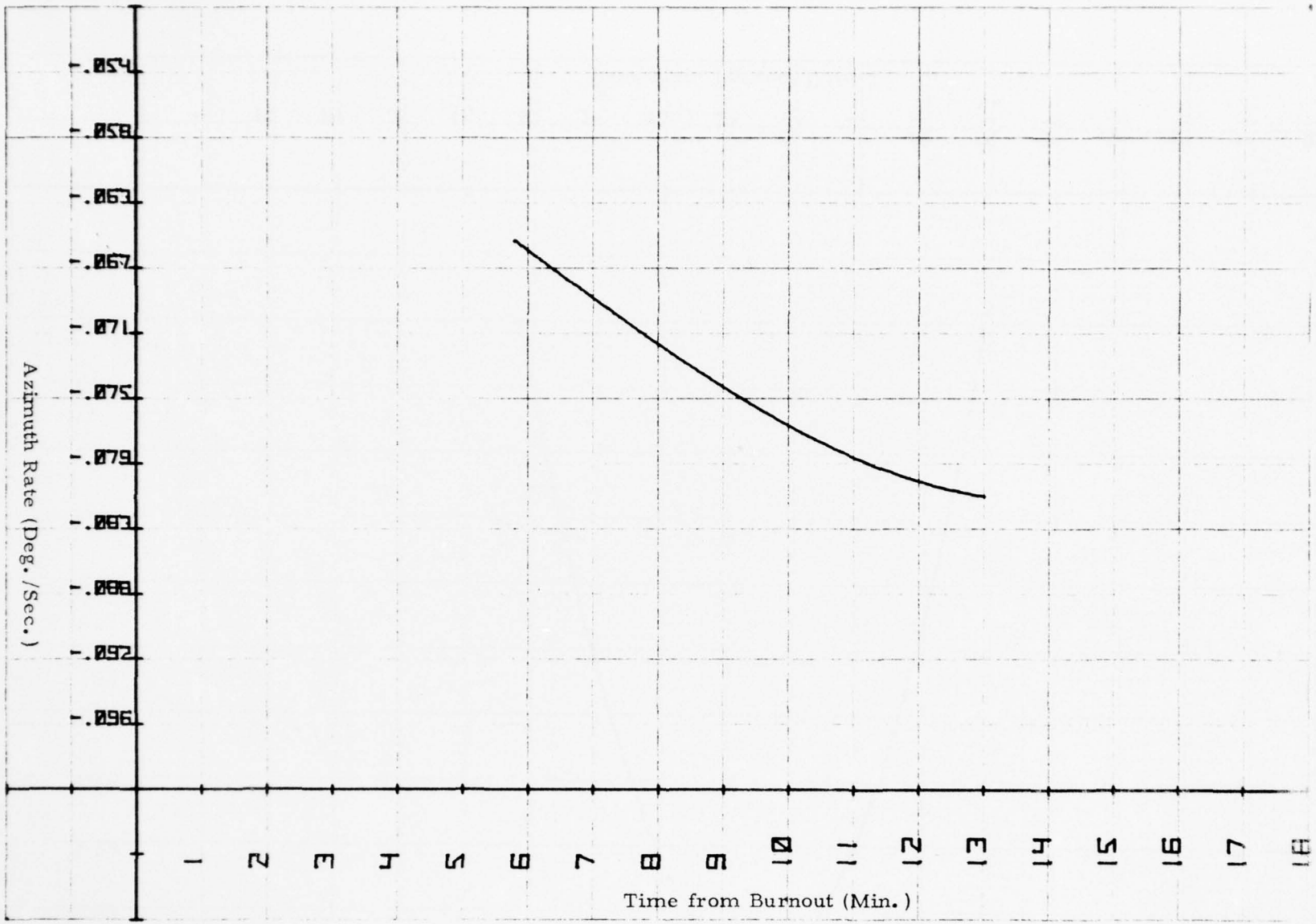
 ANGULAR SEPRATION IN RADAR BEAM = ,       0.2457805792D-01
```

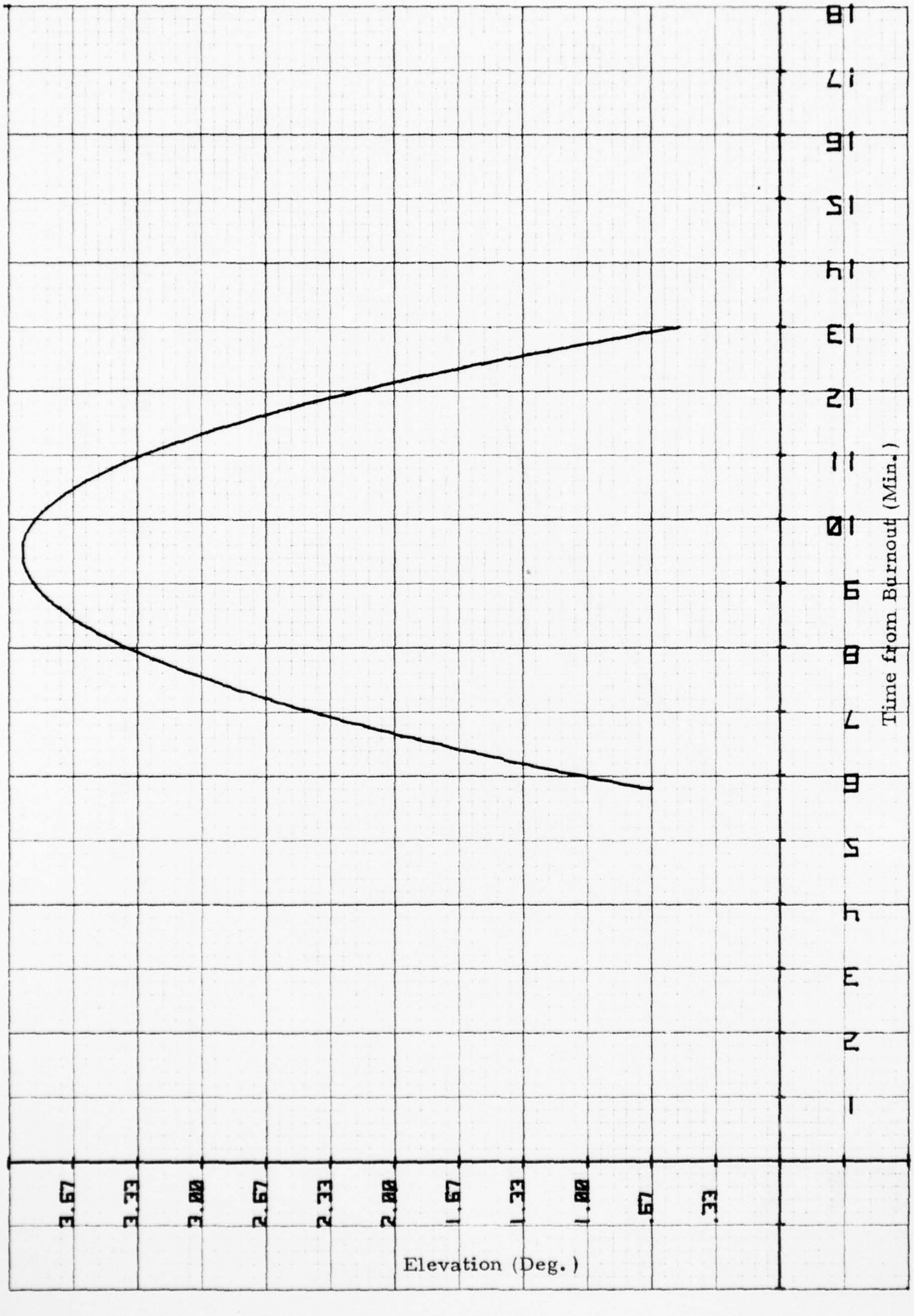
Plots from the Sample Output (for the first trajectory)

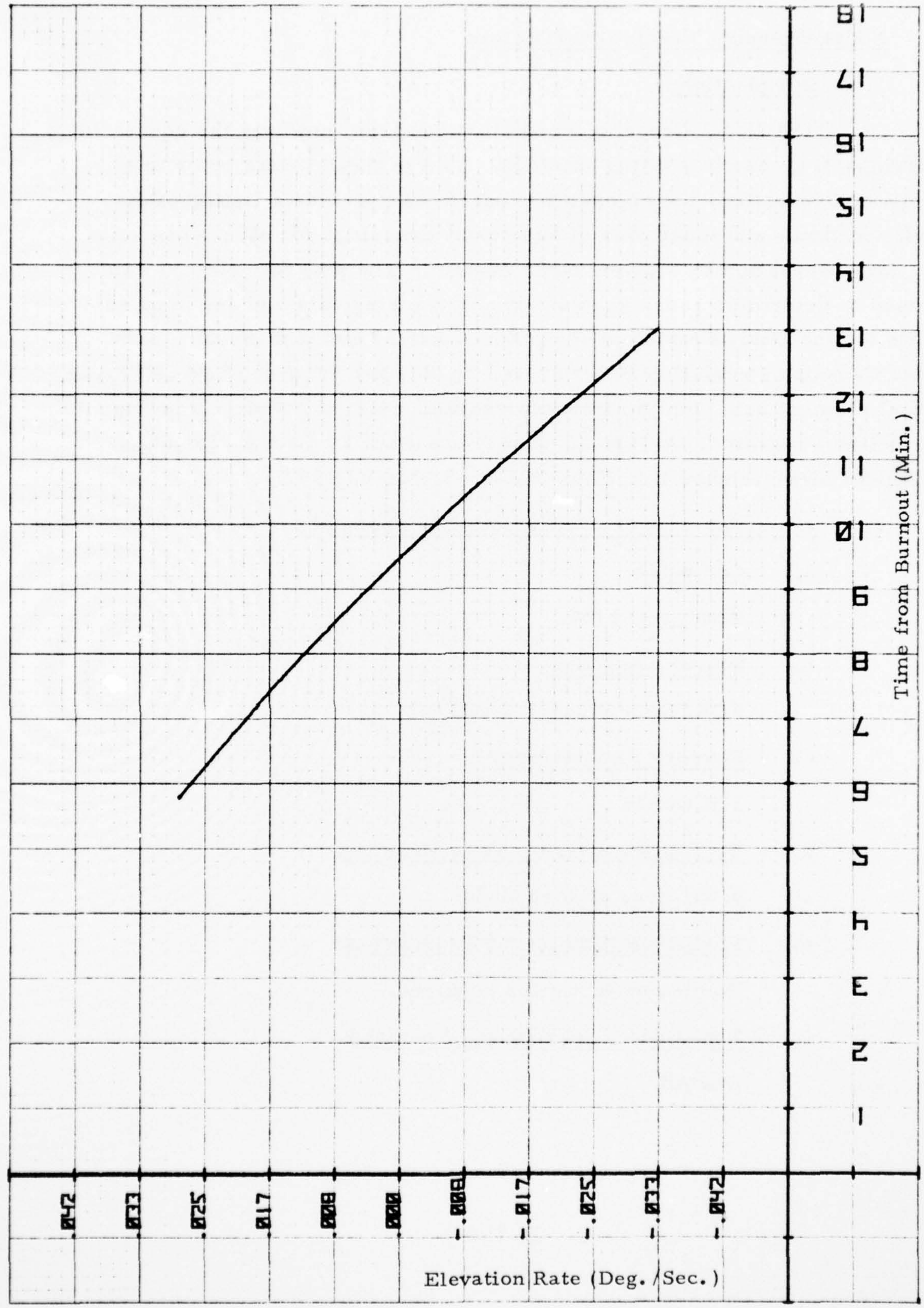

Time from Burnout (Min.)
Range (N.M.)
1770
1750
1730
1710
1690
1670
1650
1630
1610
1590
1570
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18


Time from Burnout (Min.)
Range Rate (Ft./Sec.)
-325
-650
-975
-1300
-1625
-1950
-2275
-2600
-2925
-3250
-3575




-.054
-.058
-.063
-.067
-.071
-.075
-.079
-.083
-.088
-.092
-.096
Azimuth Rate (Deg./Sec.)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Time from Burnout (Min.)


Time from Burnout (Min.)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Elevation (Deg.)
3.67 3.33 3.00 2.67 2.33 2.00 1.67 1.33 1.00 .67 .33
HEWLETT PACKARD 9270-1006



Time from Burnout (Min.)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
.042
.033
.025
.017
.008
.000
-.008
-.017
-.025
-.033
-.042
Elevation Rate (Deg./Sec.)

D. Nodal Crossing Prediction Program

1. Introduction

The Nodal Crossing Prediction Program predicts the equatorial crossings of an earth-orbiting satellite. Two to three weeks prior to a satellite observation, the computer program can provide a listing of the predicted times and longitudes of equatorial crossings for all passes suitable for observation by a given radar system. The program outputs can be used to determine radar acquisition and tracking data and are used as inputs for the Orbit Prediction Program. Orbital element inputs for the Nodal Crossing Prediction Program can be obtained from the SPACETRACK orbital element set. For further information, refer to "Nodal Crossing Prediction Program", by John C. Cleary and Paul E. Brown, 1st Lt., Technical Memorandum No. EMA-TM-66-9, March 1967.

2. Computer Program Operating Environment

a. Computer

Honeywell 6180.

b. Source Language

FORTRAN Y under GCOS.

c. Memory Requirement

17K words

d. Typical Processing Time Required

0.001 hrs. (3.6 seconds)

e. Peripheral Equipment Requirement

No disc or tape files required.

f. Non-system Subroutines Required

CLEAR

3. Inputs

The following set of input parameters are required for the execution of the Nodal Crossing Prediction Program.

NAMELIST IN1

NCASE - Number of cases to be run.

NAMELIST IN2

HED - Array containing the heading for the output. The dimension of HED is 24.

NAMELIST IN3

NTYPE - Switch for selecting orbital elements type to be input.

=1 SPACETRACK or Smithsonian elements used as inputs.

=2 NASA elements.

NREV0 - First revolution of satellite to be examined for visibility from radar. The revolutions are counted from epoch time of the SPACETRACK bulletin.

NREV1 - Last revolution of satellite to be examined for visibility from radar.

NAMELIST IN4

BGT - Epoch time of nodal crossing bulletin in decimal days. BGT=39125-T where 39125 is January 1, 1966 in Julian Days and T is the epoch time.

XM0 - Mean anomaly in degrees.

RA0 - Right ascension of ascending node in degrees.

OMEGA0 - Argument of perigee (degrees).

E - Orbit eccentricity.

A - Mean motion (revolutions/day).

NAMELIST IN5

B - Rate of change of A (revolutions/day^2).

RA1 - Rate of change of RA0 (degrees/day).

OMEGA1 - Rate of change of OMEGA0 (degrees/day).

GHA0 - Greenwich hour angle of Aries at midnight, 30 December of the previous year.

NAMELIST IN6

ZLAM1 - Longitude of northbound nodal crossings that will give a Zenith pass at the radar (degrees).

ZLAM2 - Longitude of southbound nodal crossings that will give a Zenith pass at the radar (degrees).

DLAMDA - Longitude interval of nodal crossings that will give usable passes at the radar (degrees).

CHR - Difference between local time and Greenwich time.

= 4.0 EDT

= 5.0 EST

4. Output

Output from the Nodal Crossing Prediction Program first consists of a list of the input parameters. This is followed by a listing of the nodal crossing data in the following form:

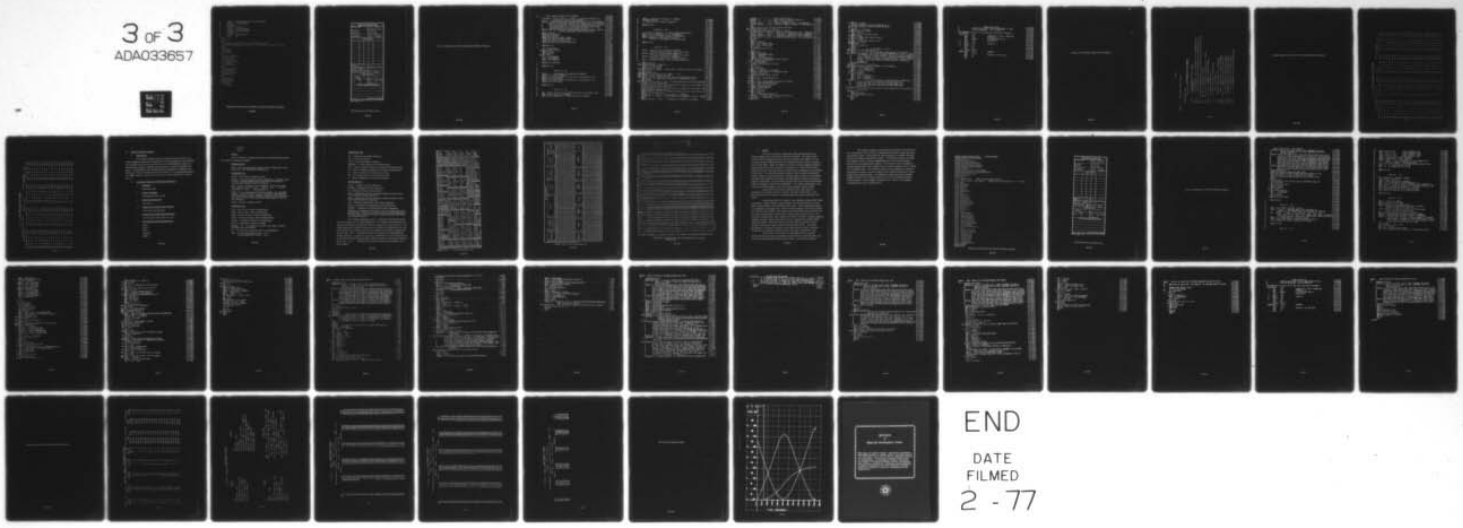
Variable Name	Units	Description
HED	None	Heading for output as input.
BGT	Decimal Days	Epoch time of nodal crossing bulletin.
NREV0, NREV1	None	Pass number. Indicates the first through last revolution of the satellite to be examined for visibility from the radar.
ZLAM1	Degrees	Longitude of northbound nodal crossings that will give a Zenith pass at the radar.
ZLAM2	Degrees	Longitude of southbound nodal crossings that will give a Zenith pass at the radar.
DLAMDA	Degrees	Longitude interval of nodal crossings that will give usable passes at the radar.
NDAY	Days	Day of year of nodal crossing.
NHR	Hours	Hour of day of nodal crossing.
MIN	Minutes	Minute of hour of nodal crossing.
NSEC	Seconds	Second of minute of nodal crossing.

Variable Name	Units	Description
PLAMDA	Degrees	Longitude of nodal crossing.

The printout produced from the variables HED through DLAMDA above serves as a heading for each page of nodal crossing data printed out. The nodal crossing times and longitude (variables NDAY through PLAMDA) are printed out in the order of ascending times on each page. Refer to the sample output.

AD-A033 657 PRC INFORMATION SCIENCES CO ROME N Y F/G 15/3
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 1, PART 1, BOOK 1. --ETC(U)
OCT 76 P R CONTI F30602-75-C-0167
UNCLASSIFIED RADC-TR-76-261-VOL-1-PT-1- NL

3 OF 3
ADA033657



END

DATE
FILMED
2 - 77

```
$       IDENT   CLEARY,NEUFFER ,65121104RADC
$       USERID  CLEARY$THREE
$       LØWLØAD
$       ØPTIØN  FØRTRAN
$       SELECT  CLEARY/ØNØDAL
$       SELECT  CLEARY/ØCLEAR
$       EXECUTE
$       LIMITS  20,20K,,10K
$       DATA    05
 $IN1
  NCASE=1 $
 $IN2
  HED(4)=34H NODAL CROSSING PREDICTIØN PROGRAM,
  HED(14)=47HSATELLITE NO. 049  - SPACETRACK - BLTN. 342 EDT$
 $IN3
  NTYPE=1,
  NREV0=75,
  NREV1=460 $
 $IN4
  BGT=118.08902403,
  XM0=203.7813,
  RA0=234.2461,
  ØMEGA0=158.7564,
  E=0.0570891,
  A=12.76771656 $
 $IN5
  D=0.255741E-03,
  RA1=-3.46557,
  ØMEGA1=3.31952,
  GHA0=99.210 $
 $IN6
  ZLAM1=134.2,
  ZLAM2=191.9,
  DLAMDA=50.0,
  CHR=4.0 $
$       ENDJØB

*
```

Sample Job Stream for the Nodal Crossing Prediction Program

RADC 635/645 BATCH JOB

SNUMB NUMBER	DATE	TIME
	4/5/76	1115
PROGRAMMER: CONTI	TELEPHONE: 339-1360	
RADC ENGINEER: CLEARY	TELEPHONE: 3573	SYMBOL: OCSA

TAPES ASSIGNED

REEL NO.	WRITE	READ	DEN.	TITLE

PERIPHERALS ASSIGNED [X] READER [X] PRINTER [ ] PUNCH
[ ] DISC. # OF LINKS ___ [ ] DRUM # OF LINKS ___

CORE SIZE 20K	ACTIVITIES 1
PROCESSOR TIME .01	ESTIMATED LINES OF PRINT 1,000
TOTAL RUN TIME .01	

DECKS EXPECTED

NO. OF BINARY DECKS: None	NO. OF COMDECKS

BMC		TAPE [ ] DUMP [ ] COPY	
FROM:	TO:	MODE [ ] BCD [ ] BINARY	NO. OF FILES

SPECIAL OPERATOR INSTRUCTIONS

(Use reverse side if required)

RADC FORM APR 69 0-56 PREVIOUS EDITION WILL BE USED

HIS 6000 Batch Submittal Form

Source Listing of the Nodal Crossing Prediction Program

```
C          NODAL CROSSING PREDICTION PROGRAM                                    00001000
C                                                                               00001010
      DIMENSION T0(1000),NDAY(1000),NHR(1000),MIN(1000),NSEC(1000),             00001020
     1          XLAMDA(1000),PLAMDA(1000),HED(24)                              00001030
      COMMON T0,NDAY,NHR,MIN,NSEC,XLAMDA,PLAMDA,HED,RAD,PI,NTYPE,NREV0,         00001040
     1       NREV1,X,BGT,E,OMEGA0,OMEGA1,XM0,P,DELP,A,B,C,GHA0,GHA1,RA0,        00001050
     2       RA1,ZLAM1,ZLAM2,PN,COSW,SINW,TERM,COSPH,SINPH,PHIP,DLAMDA,         00001060
     3       XMP,TERM1,NPASS,REV,J,I,DAY,HOUR,YMIN,SEC,NPAGE,IPAGE,             00001070
     4       JSTART,JEND,NCOL,JC1,JC2,JC3,JC4,CHR,CDAY                          00001080
      DOUBLE PRECISION GHA1,BGT,XM0,RA0,OMEGA0,E,A,B,RA1,OMEGA1,GHA0,P,         00001090
     1                 PN,TERM,TERM1,DELP,C,XMP,PI,RAD,DSQRT                    00001100
      DATA BLANK/6H      /                                                      00001110
      NAMELIST/IN1/NCASE                                                        00001120
      NAMELIST/IN2/HED                                                          00001130
      NAMELIST/IN3/NTYPE,NREV0,NREV1                                            00001140
      NAMELIST/IN4/BGT,XM0,RA0,OMEGA0,E,A                                       00001150
      NAMELIST/IN5/B,RA1,OMEGA1,GHA0                                            00001160
      NAMELIST/IN6/ZLAM1,ZLAM2,DLAMDA,CHR                                       00001170
C                                                                               00001180
      READ(05,IN1)                                                              00001190
C                                                                               00001200
      DO 51 N=1,NCASE                                                           00001210
    2 CALL CLEAR(T0,CDAY)                                                       00001220
      DO 99 I=1,24                                                              00001230
      HED(I)=BLANK                                                              00001240
   99 CONTINUE                                                                  00001250
      PI = 3.1415926536                                                         00001260
      RAD = .0174532925                                                         00001270
      GHA1 = 360.9856473                                                        00001280
C                                                                               00001290
      READ(05,IN2,END=51)                                                       00001300
C                                                                               00001310
      READ(05,IN3)                                                              00001320
C                                                                               00001330
C                                                                               00001340
C                   NAMELIST - IN3                                              00001350
C                                                                               00001360
C     NTYPE = 1 - SPACETRACK OR SMITHSONIAN ELEMENTS                            00001370
C     NTYPE = 2 - NASA ELEMENTS                                                 00001380
C     NREV0 = FIRST REVOLUTION OF SATELLITE TO BE EXAMINED FOR                  00001390
C     VISIBILITY FROM RADAR                                                     00001400
C     NREV1 = LAST REVOLUTION OF SATELLITE TO BE EXAMINED FOR                   00001410
C     VISIBILITY FROM RADAR                                                     00001420
C                                                                               00001430
      READ(05,IN4)                                                              00001440
C                                                                               00001450
C                                                                               00001460
C                   NAMELIST - IN4                                              00001470
C                                                                               00001480
C     BGT = EPOCH TIME OF NODAL CROSSING BULLETIN IN DECIMAL DAYS               00001490
C     XMO = MEAN ANOMALY IN DEGREES                                             00001500
C     RAO = RIGHT ASCENSION OF ASCENDING NODE IN DEGREES                        00001510
```

```
C      OMEGAO = ARGUMENT OF PERIGEE IN DEGREES                          00001520
C      E = ECCENTRICITY                                                 00001530
C      A = MEAN MOITION IN REVOLUTIONS/DAY                              00001540
C                                                                       00001550
       READ(05,IN5)                                                     00001560
C                                                                       00001570
C                                                                       00001580
C                    NAMELIST - IN5                                     00001590
C                                                                       00001600
C      B = RATE OF CHANGE OF A IN REVOLUTIONS/(DAY-SQUARED)             00001610
C      RA1 = RATE OF CHANGE OF RAO IN DEGREES/DAY                       00001620
C      OMEGA1 = RATE OF CHANGE OMEGAO IN DEGREES/DAY                    00001630
C      GHAO = GREENWICH HOUR ANGLE OF ARIES AT                          00001640
C             MIDNIGHT, 30 DECEMBER OF PREVIOUS YEAR                    00001650
C                                                                       00001660
       READ(05,IN6)                                                     00001670
C                                                                       00001680
C                                                                       00001690
C                    NAME_IST - IN6                                     00001700
C                                                                       00001710
C      ALAM1 = LONGITUDE OF NORTHBOUND CROSSING                         00001720
C              THAT WILL GIVE A ZENITH PASS AT THE RADAR                00001730
C      ALAM2 = LONGITUDE OF SOUTHBOUND CROSSING                         00001740
C              THAT WILL GIVE A ZENITH PASS AT THE RADAR                00001750
C      DLAMDA = LONGITUDE INTERVAL OF CROSSINGS                         00001760
C               THAT WILL GIVE USEABLE PASSES AT RADAR                  00001770
C      GMR = DIFFERENCE BETWEEN LOCAL AND GREENWICH TIME                00001780
C                                                                       00001790
       WRITE(06,9001)                                                   00001800
 9001  FORMAT(1H1,49X,'- INPUTS -')                                     00001810
       IF(N.GT.1) GO TO 998                                             00001820
       WRITE(06,9002) NCASE                                             00001830
 9002  FORMAT(///9X,'NCASE = ',I2,5X,'TOTAL NUMBER OF CASES TO BE RUN') 00001840
       GO TO 999                                                        00001850
  998  WRITE(06,9003)N                                                  00001860
 9003  FORMAT(//10X,'THIS IS RUN NUMBER   ',I2)                        00001870
  999  WRITE(06,9004) (HED(I),I=1,24)                                   00001880
 9004  FORMAT(///19X,'OUTPUT HEADING (HED)',/24X,12A6,/24X,12A6)        00001890
       WRITE(06,9005) NTYPE,NREV ,NREV1,BGT,XMO,RAO,OMEGAO,E,A,B,       00001900
      *RA1,OMEGA1                                                       00001910
 9005  FORMAT(//19X,'NTYPE = ',I5,' ,1-SPACETRACK OR SMITHSONIAN ELEMENTS00001920
      *1,/32X,' =2-NASA ELEMENTS',                                      00001930
      *//19X,'NEREV0 = ',I6,' FIRST REVOLUTION OF SATELLITE FROM EPOCH TIM00001940
      *E OF THE SPACETRACK BULLETIN',                                   00001950
      *//19X,'NREV1 = ',I6,' LAST REVOLUTION OF SATELLITE FROM EPOCH TIME00001960
      * OF THE SPACETRACK BULLETIN',                                    00001970
      *//19X,'BGT = ',F16.10,' BGT=39125-T(39125 IS JULIAN DAYS FOR JAN 100001980
      *956,T IS THE EPOCH TIME',                                        00001990
      *//19X,'XMO = ',F16.10,' MEAN ANOMALY IN DEGREES',                00002000
      *//19X,'RAO = ',F16.10,' RIGHT ASCENSION OF ASCENDING NODE IN DEGRE00002010
      *ES',                                                             00002020
      *//19X,'OMEGAO = ',F16.10,' ARGUEMENT OF PERIGEE IN DEGREES',     00002030
```

```
     *//19X,' E   = ',F16.10,' ORBIT ECCENTRICITY',                          00002040
     *//19X,' A   = ',F16.10,' MEAN MOTION IN REVOLUTIONS/DAY',             00002050
     *//19X,' B   = ',F16.10,' RATE IN CHANGE OF A',                        00002060
     *//19X,' RA1 = ',F16.10,' RATE OF CHANGE OF RAO IN DEGREES/DAY',       00002070
     *//19X,'OMEGA1 = ',F16.10,'RATE OF CHANGE OF OMEGAO IN DEGREES/DAY     00002080
     *')                                                                    00002090
      WRITE(06,9006) GHAO,ZLAM1,ZLAM2,DLAMDA,CHR                           00002100
 9006 FORMAT(/19X,'GAHO = ',F16.10,                                        00002110
     *' GREENWICH MOJR ANGLE OF ARIES AT NIGHT',                           00002120
     *//19X,'ZLAM1 = ',F16.10,' LONGITUDE OF NORTHBOUND NODAL CROSSING',   00002130
     *//19X,'ZLAM2 = ',F16.10,' LONGITUDE OF SOUTHBOUND NODAL CROSSING',   00002140
     *//19X,'DLAMDA = ',F16.10,' LONGITUDE INTERVAL OF NODAL CROSSING',    00002150
     *//19X,'CHR = ',F16.10,' DIFFERENCE BETWEEN LOCAL TIME AND GREENWIC   00002160
     *H TIME',                                                             00002170
     *//1H1)                                                               00002180
      CDAY = CHR/24.0                                                      00002190
      COSW = COS (OMEGA *RAD)                                              00002200
      SINW = SIN (OMEGA *RAD)                                              00002210
      P = 1D0/A                                                            00002220
      IF(NTYPE.EQ.1) GO TO 6                                               00002230
      P = A                                                                00002240
      DELP = B                                                             00002250
    6 TERM = 1D0-E**2                                                      00002260
      TERM = TERM*DSQRT(TERM)                                              00002270
      TERM1 = E*COSW                                                       00002280
      TERM1 = (1D0+TERM1)**2                                               00002290
      PN = P*(1D0-OMEGA1*P*TERM/(360D0*TERM1))                             00002300
    7 IF (NTYPE.EQ.1) GO TO 9                                              00002310
    8 E = DELP*P/28800                                                     00002320
C      2880 = 2*(1440 MIN IN A DAY)                                        00002330
      GO TO 10                                                             00002340
    9 E = -B/A**3                                                          00002350
      XMO = XMO/360D0                                                      00002360
   10 COSPH = (COSW+E)/(1.0+E*COSW)                                        00002370
      SINPH = SIGN (SQRT (1.0-COSPH**2),SINW)                              00002380
      IF(COSPH)12,11,13                                                    00002390
   11 PHIP = PI-SIGN (PI/2.0,SINPH)                                        00002400
      GO TO 14                                                             00002410
   12 PHIP = ATAN (SINPH/COSPH)+PI                                         00002420
      GO TO 14                                                             00002430
   13 PHIP = ATAN (SINPH/COSPH)+PI-SIGN (PI,SINPH)                         00002440
   14 XMP = (PHIP-E*SINPH)/(2D0*PI)                                        00002450
      TERM = BGT+(1D0-XMO-XMP)*PN                                          00002460
   15 TERM1 = 360D0-RAO+GHAO                                               00002470
      NPASS = NREV1-NREVO+1                                                00002480
      REV = NREVO-1                                                        00002490
   16 DO 18 I=1,NPASS                                                      00002500
      REV = REV+1.0                                                        00002510
      TO(I) = TERM+REV*PN+C*REV**2                                         00002520
   17 XLAMDA(I) = TERM1-RA1*(TO(I)-BGT)+GHA1*TO(I)                         00002530
      XLAMDA(I) = AMOD(XLAMDA(I),360.)                                     00002540
   18 CONTINUE                                                             00002550
```

```
      J = 0                                                                 00002560
   19 DO 26 I=1,NPASS                                                       00002570
      IF(ABS (XLAMDA(I)-ZLAM1)-DLAMDA)21,21,20                              00002580
   20 IF(ABS (XLAMDA(I)-ZLAM2)-DLAMDA)21,21,26                              00002590
   21 J = J+1                                                               00002600
      XLAMDA(J) = XLAMDA(I)                                                 00002610
   22 NDAY(J) = T0(I)-CDAY                                                  00002620
      DAY = NDAY(J)                                                         00002630
      HOUR = (T0(I)-DAY)*24.0-CHR                                           00002640
   23 NHR(J)=HOUR                                                           00002650
      YMIN = (HOUR-FLOAT (NHR(J)))*60.0                                     00002660
   24 MIN(J) = YMIN                                                         00002670
      SEC = (YMIN-FLOAT (MIN(J)))*60.0                                      00002680
   25 XSEC(J) = SEC+.5                                                      00002690
   26 CONTINUE                                                              00002700
      NPAGE = (J+99)/100                                                    00002710
      IPAGE = 1                                                             00002720
   27 WRITE          (6  ,1003)(HED(I),I=1,24)                              00002730
 1003 FORMAT(1H1,23X12A6/24X12A6//)                                         00002740
      WRITE          (6  ,1004)BGT,NREV0,NREV1,ZLAM1,ZLAM2,DLAMDA          00002750
 1004 FORMAT(18X12HEPOCH TIME =F9.5,5H DAYS,37X8HPASS NO. I4,2H - I4/11X    00002760
     1       10HLAMBDAZ1 =F8.3,22X10HLAMBDAZ2 =F8.3,20X14HDELTA LAMBDA =    00002770
     2       F8.3 //3X3HDAY,1X3HHR.,1X4HMIN.,1X4HSEC.,1X6HLAMBDA,6X3HDAY   00002780
     3      1X3HHR.,1X4HMIN.,1X4HSEC.,1X6HLAMBDA,6X3HDAY,1X3HHR,1X4HMIN.   00002790
     4      1X4HSEC.,1X6HLAMBDA,6X3HDAY,1X3HHR.,1X4HMIN.,1X4HSEC.,1X       00002800
     5      6HLAMBDA )                                                     00002810
      IF(NPAGE)28,28,29                                                     00002820
   28 WRITE          (6  ,1005                                            )00002830
 1005 FORMAT(43X34HNO VISIBLE PASSES IN THIS INTERVAL )                     00002840
   29 JSTART = 100*(IPAGE-1)+1                                              00002850
      JEND =  MIN0 (JSTART+99,J)                                            00002860
      NCOL = (JEND-JSTART+4)/4                                              00002870
   30 DO 32 I=1,NCOL                                                        00002880
      JC1 = JSTART+I-1                                                      00002890
      JC2 =  MIN0 (JC1+NCOL,J)                                              00002900
      JC3 =  MIN0 (JC2+NCOL,J)                                              00002910
      JC4 =  MIN0 (JC3+NCOL,J)                                              00002920
   31 WRITE          (6  ,1006)NDAY(JC1),NHR(JC1),MIN(JC1),NSEC(JC1),      00002930
     1       PLAMDA(JC1),NDAY(JC2),NHR(JC2),MIN(JC2),NSEC(JC2),           00002940
     2       PLAMDA(JC2),NDAY(JC3),NHR(JC3),MIN(JC3),NSEC(JC3),           00002950
     3       PLAMDA(JC3),NDAY(JC4),NHR(JC4),MIN(JC4),NSEC(JC4),           00002960
     4       PLAMDA(JC4)                                                  00002970
 1006 FORMAT(/I6,I4,I4,I4,F9.2,I9,I4,I4,I4,F9.2,I9,I4,I4,I4,F9.2,I9,I4,   00002980
     1       I4,I4,F9.2 )                                                 00002990
   32 CONTINUE                                                            00003000
      IPAGE = IPAGE+1                                                     00003010
      IF(IPAGE-NPAGE)27,27,51                                             00003020
   51 CONTINUE                                                            00003030
      STOP                                                                00003040
      END                                                                 00003050
```

```
*                          SUBROUTINE CLEAR                                    00001000
*               SUBROUTINE TO SET FORTRAN LOCATIONS TO ZERO                    00001010
*               CALLING SEQUENCE - CALL CLEAR(X,Y)                             00001020
*                                                                              00001030
*THE PURPOSE OF CLEAR IS TO ZERO OUT LOCATIONS X THROUGH Y                     00001040
 CLEAR  SAVE    1,4                                                            00001050
        LDA     2,1             ADDRESS OF X INTO A REGISTER                   00001060
        SBA     3,1             ADDRESS OF Y                                   00001070
        TPL     ORDER           Y IS GREATER THAN X                            00001080
        LDX4    2,1             RESTORE X4                                     00001090
 A2     STZ     0,4                                                            00001100
        EAX4    1,4             INCRE X4                                       00001110
 A1     CMPX4   3,1                                                            00001120
        TNC     A2                                                             00001130
        TZE     A2                                                             00001140
        RETURN  CLEAR                                                          00001150
 ORDER  LDX4    3,1             REORDER                                        00001160
        LDQ     -1,DU                                                          00001170
        ASQ     A1              CHANGE A1 TO CMPM 2,1                          00001180
        TRA     A2                                                             00001190
        END                                                                    00001200
```

Listing of the Sample Input for the Program

- INPUTS -

NCASE = 1 TOTAL NUMBER OF CASES TO BE RUN

OUTPUT HEADING (HED)

NODAL CROSSING PREDICTION PROGRAM
SATELLITE NO. 049 @ SPACETRACK - BLTN. 342 EDT

NTYPE = 1 ,1-SPACETRACK OR SMITHSONIAN ELEMENTS
=2-NASA ELEMENTS

NERV = 75 FIRST REVOLUTION OF SATELLITE FROM EPOCH TIME OF THE SPACETRACK BULLETIN

NREV1 = 46 LAST REVOLUTION OF SATELLITE FROM EPOCH TIME OF THE SPACETRACK BULLETIN

BGT = 118.[illegible]69024[illegible]800 BGT=39125=T(39125 IS JULIAN DAYS FOR JAN 1966,T IS THE EPOCH TIME

XM = 2[illegible]3.7818[illegible]000 MEAN ANOMALY IN DEGREES

RA = 234.2461[illegible]0 000 RIGHT ASCENSION OF ASCENDING NODE IN DEGREES

OMEGAO = 158.756400[illegible]00 ARGUEMENT OF PERIGEE IN DEGREES

E = [illegible].57089100[illegible] ORBIT ECCENTRICITY

A = 12.7677165632 MEAN MOTION IN REVOLUTIONS/DAY

B = [illegible].[illegible]255741[illegible] RATE IN CHANGE OF A

RA1 = -3.46557[illegible]0032 RATE OF CHANGE OF RA IN DEGREES/DAY

OMEGA1 = [illegible]3.319520[illegible]0RATE OF CHANGE OF OMEGAO IN DEGREES/DAY

GAH[illegible] = 99.210[illegible].0 00[illegible] GREENWICH HOUR ANGLE OF ARIES AT NIGHT

Z_AM1 = 134.20[illegible]00076 LONGITUDE OF NORTHBOUND NODAL CROSSING

Z_AM2 = 191.89999962 LONGITUDE OF SOUTHBOUND NODAL CROSSING

D_AMDA = 50.[illegible]000[illegible]00 LONGITUDE INTERVAL OF NODAL CROSSING

CHR = 4. [illegible]000 DIFFERENCE BETWEEN LOCAL TIME AND GREENWICH TIME

Sample Output for the Nodal Crossing Prediction Program

NODAL CROSSING PREDICTION PROGRAM
SATELLITE NO. 849 - SPACETRACK - 3LTN. 342 EDT

EPOCH TIME =118.089 2 DAYS — PASS NO, 75 - 460

LAMBDAZ1 = 134.2 — LAMBDAZ2 = 191.900 — DELTA LAMBDA = 50.000

DAY	HR.	MIN.	SEC.	LAMBDA	DAY	HR.	MIN.	SEC.	LAMBDA	DAY	HR.	MIN.	SEC.	LAMBDA	DAY	HR.	MIN.	SEC.	LAMBDA
124	2	29	54	1 6.35	128	6	[illegible]	42	177.51	132	22	38	54	87.95	137	2	7	35	158.57
124	4	22	54	134.86	128	7	53	21	206. 2	133	[illegible]	31	32	116.45	137	4	[illegible]	12	187.07
124	6	15	14	153.38	128	9	45	60	234.53	133	2	24	9	144.96	137	5	52	48	215.57
124	8	7	54	191.89	129	[illegible]	47	9	102.6	133	4	16	47	173.46	137	22	46	15	112.06
124	10	[illegible]	54	22 .41	129	2	39	48	131.11	133	6	9	24	201.97	138	0	38	51	140.56
125	1	1	52	85.52	129	4	32	27	159.62	133	8	2	2	230.47	138	2	31	27	169.06
125	2	54	52	117.03	129	6	25	5	188.13	133	23	3	1	98.50	138	4	24	3	197.56
125	4	47	11	145.55	129	8	17	44	216.64	134	[illegible]	55	38	127.00	138	6	16	4[illegible]	226.06
125	6	39	51	174.06	129	23	18	51	84.71	134	2	48	15	155.51	138	21	17	28	94.04
125	8	32	31	2 2.57	13	1	11	30	113.21	134	4	4[illegible]	53	184.01	138	23	10	4	122.54
125	10	25	[illegible]	231.09	13	3	4	8	141.72	134	6	33	30	212.51	139	1	2	4[illegible]	151.04
126	1	26	25	99.19	13	4	56	47	170.23	134	8	26	7	241.02	139	2	55	16	179.54
126	3	19	6	127.7	13	6	47	25	198.74	134	23	27	4	109.04	139	4	47	52	208.03
126	5	11	45	156.22	13	8	42	3	227.24	135	1	19	41	137.54	139	6	40	28	236.53
126	7	4	25	184.73	13	23	43	9	95.3	135	3	12	18	166.04	139	21	41	14	1[illegible]4.51
126	8	57	4	213.24	131	1	35	47	123.61	135	5	4	55	194.55	139	23	33	49	133.00
126	10	49	43	241.75	131	3	28	25	152.32	135	6	57	32	223.05	140	1	26	25	161.50
127	1	5[illegible]	57	1 9.65	131	5	21	3	180.82	135	21	58	26	91.06	140	3	19	[illegible]	190.00
127	3	43	46	138.36	131	7	13	41	209.33	135	23	51	3	119.56	140	5	11	36	218.49
127	5	36	15	156.87	131	9	6	19	237.84	136	1	43	40	148.06	140	20	12	20	86.46
127	7	28	55	195.38	132	[illegible]	7	22	105.49	136	3	36	17	176.56	140	22	4	56	114.96
127	9	21	34	223.89	132	1	59	60	134.39	136	5	28	53	205.06	140	23	57	31	143.45
128	[illegible]	22	46	91.98	132	3	52	38	162.9	136	7	21	30	233.57	141	1	50	6	171.95
128	2	15	24	12 .49	132	5	45	15	191.4	136	22	22	22	101.57	141	3	42	42	200.44
128	4	8	3	149.[illegible]	132	7	37	53	219.91	137	[illegible]	14	59	130.07	141	5	35	17	228.94

NODAL CROSSING PREDICTION PROGRAM
SATELLITE NO. 049 - SPACETRACK - BLTN. 342 EDT

EPOCH TIME =118.08902 DAYS
LAMBDAZ1 = 134.200
LAMBDAZ2 = 191.900
PASS NO. 75 - 460
DELTA LAMBDA = 50.000

DAY	HR.	MIN.	SEC.	LAMBDA	DAY	HR.	MIN.	SEC.	LAMBDA	DAY	HR.	MIN.	SEC.	LAMBDA	DAY	HR.	MIN.	SEC.	LAMBDA
141	20	35	59	96.90	144	21	46	33	128.11	148	0	49	9	187.68	151	16	58	59	86.49
141	22	28	34	125.39	144	23	39	8	156.60	148	2	41	42	216.17	151	18	51	31	114.97
142	0	21	9	153.89	145	1	31	42	185.10	148	19	34	43	112.55	151	20	44	3	143.45
142	2	13	44	182.38	145	3	24	16	213.59	148	21	27	16	141.04	151	22	36	36	171.94
142	4	6	19	21 .87	145	20	17	24	110.[illegible]	148	23	19	49	169.52	152	0	29	8	200.42
142	5	58	54	239.37	145	22	9	58	138.49	149	1	12	22	198.01	152	2	21	41	228.90
142	20	59	34	107.32	146	0	2	32	166.98	149	3	4	55	226.49	152	17	21	59	96.76
142	22	52	9	135.81	146	1	55	6	195.47	149	18	5	20	94.38	152	19	14	31	125.24
143	0	44	44	164.30	146	3	47	40	223.96	149	19	57	53	122.87	152	21	7	3	153.73
143	2	37	18	192.80	146	18	48	11	91.87	149	21	50	26	151.35	152	22	59	35	182.21
143	4	29	53	221.29	146	20	4[illegible]	45	120.36	149	23	42	59	179.84	153	0	52	7	210.69
143	19	30	31	89.23	146	22	33	18	148.85	15[illegible]	1	35	32	208.32	153	2	44	40	239.17
143	21	23	5	117.72	147	0	25	52	177.34	15	3	28	5	236.81	153	17	44	56	107.02
143	23	15	40	146.22	147	2	18	26	205.83	15	18	28	27	104.68	153	19	37	28	135.50
144	1	8	15	174.71	147	4	1[illegible]	60	234.31	15[illegible]	20	21	0	133.17	153	21	29	59	163.98
144	3	0	49	203.2[illegible]	147	19	11	29	102.22	15[illegible]	22	13	33	161.65	153	21	29	59	163.98
144	4	53	24	231.69	147	21	4	2	130.71	151	0	6	5	190.14	153	21	29	59	163.98
144	19	53	59	99.62	147	22	56	35	159.19	151	1	58	38	218.62	153	21	29	59	163.98

E. Orbit Prediction Program

1. Introduction

The Orbit Prediction Program simulates the trajectory of an earth-orbiting satellite and computes the radar look angles for the satellite. The satellite trajectory is generated from the SPACETRACK orbital elements and parameters obtained from the Nodal Crossing Prediction Program. A description of the Orbit Prediction Program is contained in the document: "Nodal Crossing Prediction Program", Technical Memorandum No. EMA-TM-66-9, March 1967, by John C. Cleary and Paul E. Brown, 1st Lt.

2. Computer Program Operating Environment

a. Computer

Honeywell 6180

b. Source Language

FORTRAN Y under GCOS.

c. Memory Requirement

32K words

d. Typical Processing Time Required

0.005 hours (18 seconds)

e. Peripheral Equipment Requirement

Two disc files (file codes: 01, 02)

f. Non-system Subroutines Required

OUT1
OUT2
OUT3
PARALX
NEWT

CLEAR

OUT4

3. Inputs

The following set of input parameters is required for execution of the Orbit Prediction Program:

NAMELIST IN1

HED - Array containing the heading for the output from a program run. The dimension of HED is 24.

NAMELIST IN2

NRUN - Run number assigned to pass.

NPRLX - Used in original version of program, no longer valid. If not 0, a punched paper tape for parallex correction of a transportable station would be produced.

NDL - Number of passes to be computed. First the on time pass, then the one for $\lambda + \Delta\lambda$, then $\lambda - \Delta\lambda$, $\lambda + 2\Delta\lambda$ and finally $\lambda - 2\Delta\lambda$. Normally use 2.

NOPT - If = 0, Subroutine OUT3 is not called. If = any other number, Subroutine OUT3 is called to print out the satellite orbit look angles, range, azimuth, elevation, and also Subroutine OUT4 is called to place this look angle data on a file for later plotting.

NDCH - Program division check.

NAMELIST IN3

DAY - Day of year, nodal crossing time.

THR - Hour of day, nodal crossing time.

TMIN - Minute of hour, nodal crossing time.

TSEC - Second of minute, nodal crossing time.

AMDA0 - Longitude of nodal crossing (deg.).

BGT0 - Eopch time of nodal crossing.

DAMDA - $\Delta\lambda$ (-.5 degrees is 2 min. early pass, which is normally the second pass).

DT - The interval in seconds between computations.

CHR - If converting GMT to EDT, = 4.0.
If converting GMT to EST, = 5.0.

NAMELIST IN4

W0 - Argument of perigee (degrees).

E0 - Orbit eccentricity.

ANCL - Orbit inclination (degrees).

ASMTH - A, mean motion in revolutions/day.

RA1 - Rate of change of right ascending node (degrees/day).

W1 - Rate of change of argument of perigee (degrees/day).

E1 - Rate of change of eccentricity, per day.

A0 - Semi-major axis of orbit in earth radii.

A1 - Rate of change of A0 in earth radii/day.

NAMELIST IN5

XLAT - Latitude of radar (degrees).

XLONG - Longitude of radar (degrees).

AD - Radius of earth at radar in Km.

AZTH - Maximum allowed azimuth deviation of beam center from satellite position (degrees).

ALTH - Maximum allowed elevation deviation of beam center from satellite position (degrees).

ALO - Initial elevation angle of the pass (degrees).

XLAT1 - Latitude of transportable station (degrees).

XLONG1 - Longitude of transportable station (degrees).

TDELAY - Transmitter time delay, used to compute the range mark number. This is a number that describes the setting of 5 switches at the transmitter to get a properly timed range mark for starting the pass.

The following page (Fig. III-3) represents the format for the six card element set from SPACETRACK. The orbital element parameters used in this program (NAMELIST IN4) are obtained from this card set. The orbital parameters needed in the program can also be obtained from the two card element set and hand calculation of required parameters missing from the set. Fig. III-4 illustrates this latest format for the SPACETRACK orbital elements. A punched card deck, containing the two card element set, as received by RADC from the Space Defense Center in Colorado is illustrated in Fig. III-5. The first card of the actual deck is the bottom card in the figure.

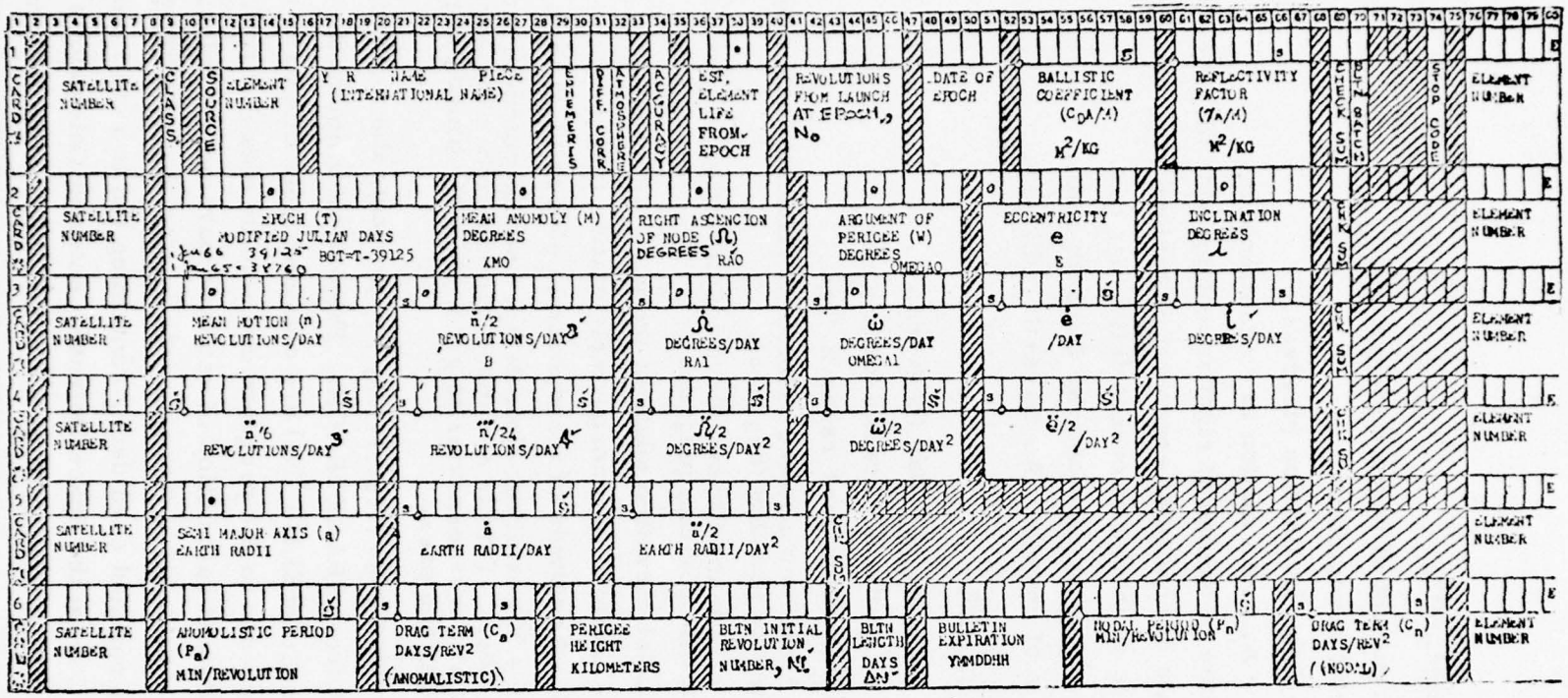


Figure III-3. Six Card Element Set

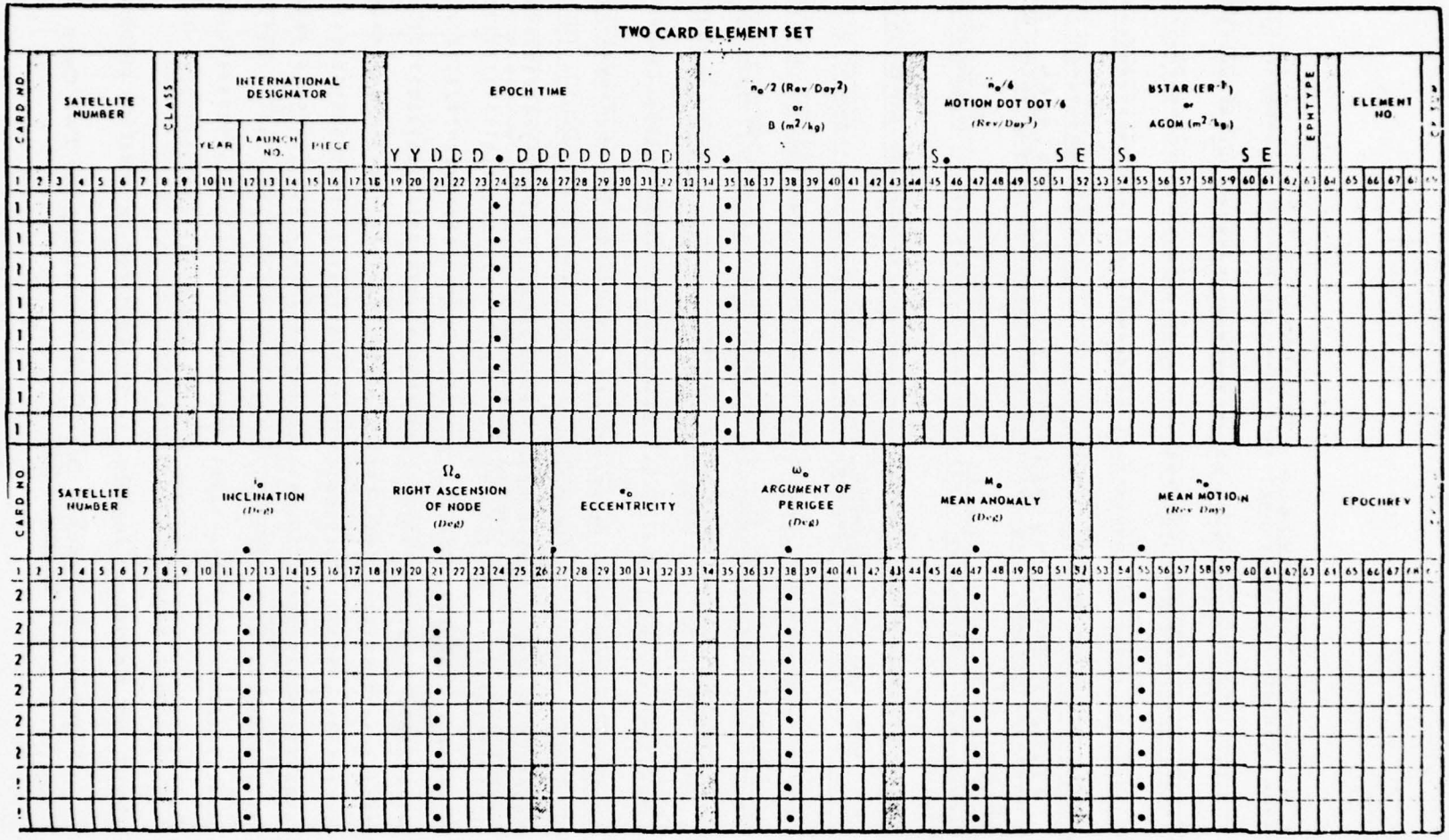
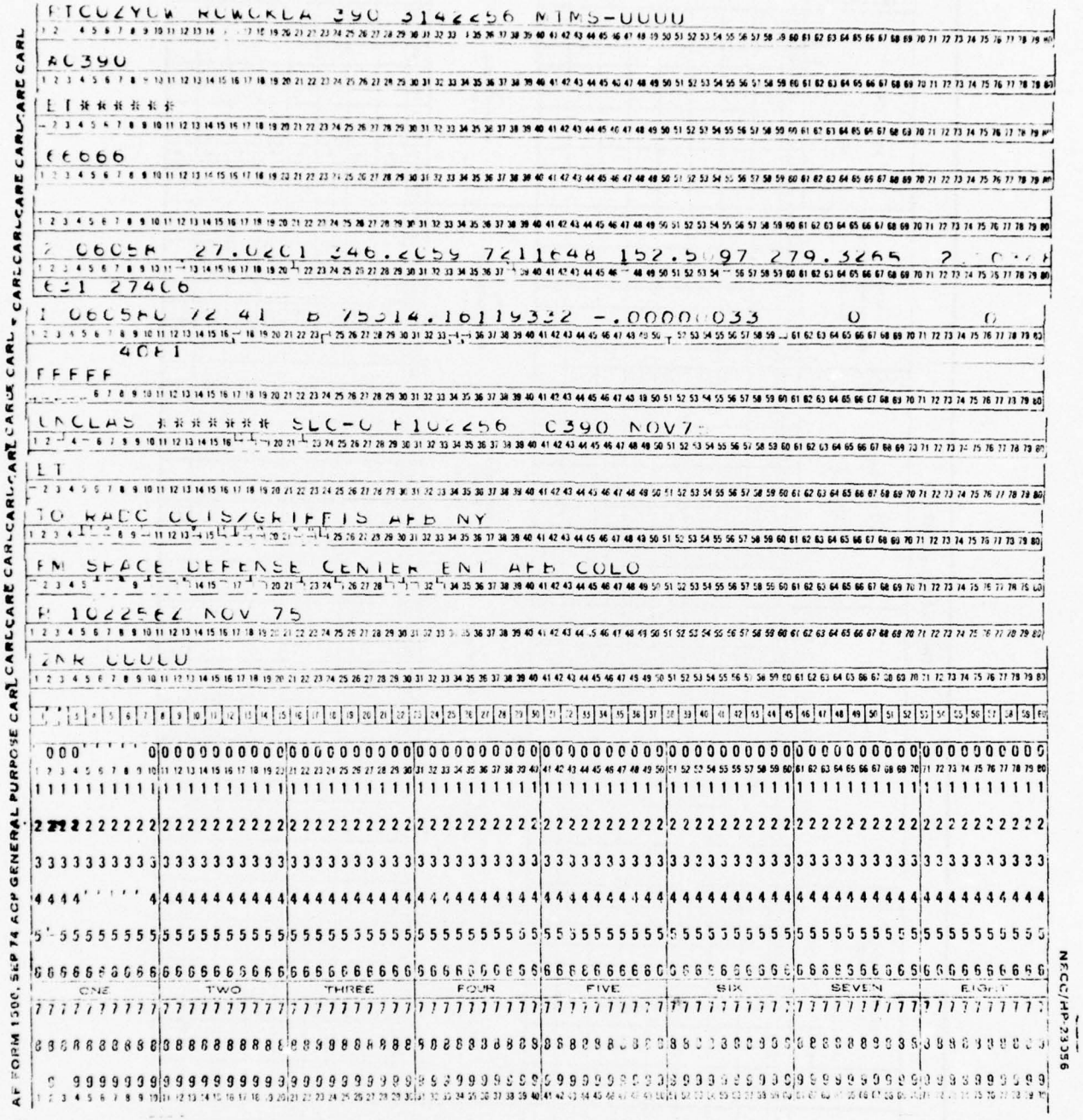


Figure III-4. Two Card Element Set



The page, although not completely legible, is included for information purposes only.

Figure III-5. Punched Data Deck Containing the Two Card Element Set

4. Output

There are a number of different output quantities produced during a typical run of the Orbit Prediction Program. By means of Subroutine OUT1 the input heading for the run (variable name HED), the run and pass numbers (NRUN and M), the satellite rise time in hours, minutes, and seconds (MHR, IMIN, and ISEC), the nodal crossing longitude (AMBA), and the epoch time in days (BGT0) are printed out. This is followed by a listing of various radar parameters versus times of visibility of the satellite to the radar. The radar parameters listed are the elevation count period (ECP), azimuth count period (ACP), elevation angle in degrees and minutes (variable names MELD and MELM), azimuth angle in degrees and minutes (MAZD and MAZM), range in kilometers (R) and return time in milliseconds (RM), and Doppler in kilocycles (DOPLER). For further explanation of the count periods and Doppler refer to the last paragraph of this section.

Subroutine OUT2 produces printout of the input data and parameters associated with the recorder, director, and tracker. The printout from OUT2 occurs on a separate page following the printout from OUT1.

If Subroutine OUT3 is invoked, then additional output of the radar look angles, range, azimuth, and elevation, will be generated for various times of observation of the satellite by the radar. These observation times are separated by the input DT. First the input heading for the run is printed out (variable name HED). Then follows the run and pass number (NRUN and M), nodal crossing time in day of year, hour of day, minute of hour, and second of minute (DAY, THR, TMIN, and TSEC), the nodal crossing longitude (AMBA), and the satellite rise time in hours, minutes, and seconds (MHR, IMIN, and ISEC). After this follows a list of radar parameters versus satellite observation times, separated by intervals of DT. The radar parameters are azimuth in degrees and radians (AZ and AZR), elevation in degrees and radians (ALPH and ELR), and range in kilometers (R).

When NOPT is not equal to 0, Subroutine OUT4 is called. OUT4 will place the radar data printed out by OUT3 on a data file (file code 02) for use in producing off-line plots of range, azimuth, and elevation.

The outputs elevation count period and azimuth count period are the count periods to be set into the programmed antenna tracker elevation and azimuth clocks. These data are used to prepare a magnetic tape that controls an antenna programmed tracker. This tape has pulses recorded at the proper rates to control stepping motors which in turn, position synchros to command pointing angles. The data shown in the output are actually proportional to the required periods between pulses to be recorded on the program tape. The numbers shown are the settings to be entered into present counters to produce pulses at the required spacing for use in preparing the program tape. An additional column shows the requisite Doppler frequency corrections required due to the translational motion of the satellite. These Doppler frequencies are used to cut a Doppler compensator cam for a satellite pass.

```
0010$:IDENT:CLEARY,CONTI     ,65121104RADC
0020$:USERID:CLEARY$THREE .
0030$:LOWLOAD
0040$:OPTION:FORTRAN
0050$:SELECT:CLEARY/00RB
0060$:SELECT:CLEARY/0CLEAR
0065$:SELECT:CLEARY/00UT4
0070$:EXECUTE
0080$:LIMITS:10,32K,-5K,12000
0085$:PRMFL:02,R/W,L,CLEARY/STORE1
0086$:DISC:01,AIR,5L
0090$:DATA:05
0100 $IN1
0110  HED(5)=30H     ORBIT PREDICTION PROGRAM    ,
0120 HED(13)=54H 1 MIN EARLY     OBJECT NO. 2108 BLTN NO. 7  4/1/66     $
0130 $IN2
0140 NRUN=302,
0150 NPRLX=0,
0160 NDL=1,
0170 NOPT=10,
0180 NDCH=-10 $
0190 $IN3
0200 DAY=91.0,
0210 THR=3.0,
0220 TMIN=32.0,
0230 TSEC=57.0,
0240 AMDA0=96.100,
0250 BGT0=36.0134,
0260 DAMDA=0.0,
0270 DT=5.0,
0280 CHR=4.0 $
0290 $IN4
0300  W0=53.070,
0310  E0=0.021690,
0320  ANCL=72.090,
0330  RA1=-2.52163,
0340  W1=-2.16126,
0350  ASMTH=15.67614,
0360  E1=-2.4600E-04,
0370  A0=1.05752,
0380  A1=-2.6600E-04 $
0390 $IN5
0400  XLAT=43.15250,
0410  XLONG=75.61722,
0420  AD=6365.30,
0430  AZTH=0.100,
0440  ALTH=0.100,
0450  XLAT1=0.0,
0460  XLONG=0.0,
0470  TDELAY=25.0 $
0480$:ENDJOB
0490***EOF
```

Sample Job Stream for the Orbit Prediction Program

RADC 635/645 BATCH JOB

$NUMB NUMBER	DATE	TIME
	3/30/76	910

PROGRAMMER	TELEPHONE
CONTI	339-1360

RADC ENGINEER	TELEPHONE	SYMBOL
CLEARY	3573	OCSA

TAPES ASSIGNED

REEL NO.	WRITE	READ	DEN	TITLE

PERIPHERALS ASSIGNED
[X] READER [X] PRINTER [ ] PUNCH
[X] DISC # OF LINKS 10 [ ] DRUM # OF LINKS ____

CORE SIZE 32K	ACTIVITIES 1
PROCESSOR TIME .01	ESTIMATED LINES OF PRINT 500
TOTAL RUN TIME .02	

DECKS EXPECTED

NO. OF BINARY DECKS None	NO. OF COMDECKS

BMC		TAPE [ ] DUMP [ ] COPY	
FROM:	TO:	MODE [ ] BCD [ ] BINARY	NO. OF FILES

SPECIAL OPERATOR INSTRUCTIONS

(Use reverse side if required)

RADC FORM APR 69 0-56 PREVIOUS EDITION WILL BE USED

HIS-6000 Batch Submittal Form

Source Listing of the Orbit Prediction Program

```
C         ORBIT PREDICTION - MAIN PROGRAM                                       00001000
      DIMENSION TM(1500),AZ(1500),ALPH (1500),R(1500),PHI(1500),                00001010
     1          THETA(1500),RHO(1500),D(1500),ECP(750),ACP(750),               00001020
     2          HED(24),XLAM(5)                                                00001030
      COMMON TM,AZ,ALPH,R,PHI,THETA,RHO,D,ECP,ACP,ICP,HED,XLAM,TO,DT,           00001040
     1       CTO,AMDA0,AMDA1,DAMDA,W0,W1,E0,E1,ANCL,A,P,XLAT,XLONG,AD,          00001050
     2       SANCL,CANCL,SLAT,CLAT,RLONG,L,M,J,T,W,AMDA,AMBA,E,V,PHIG,          00001060
     3       CTH,TH,DELL,SD,CD,CDL,SDL,COSB,SINB,TANALF,RSQ,COSAZ,TAZ,          00001070
     4       NN,N1,N2,XW,XL,XE,RAMDA,RW,CP0,PHI0,SP0,STH,X,SINAZ,RW1,           00001080
     5       SPHI,CON,AZTH,ALTH,AL0,I,IALS,JJ,KK,N02,OPT,DELN,GAMN,             00001090
     6       MMIN,MSEC,DPLR,DEN,DFN,TT,MHR,HR,IMIN,YMIN,ISEC,TMIN,J1            00001100
      COMMON NRUN,NPRLX,NDL,NOPT,NDCH,DAY,THR,TSEC,AZMTH,CHR,PI,RAD,            00001110
     1       RAD,NA,NB,NC,ND,NE,RRATE,BGT0,A0,A1,XLAT1,XLONG1,TDELAY,           00001120
     2       DOPLER,V,INDX,TMTP,NERL,CTIME,ASMTH,RLONG1,SLAT1,CLAT1             00001130
      NAMELIST/IN1/HED                                                          00001140
      NAMELIST/IN2/NRUN,NPRLX,NDL,NOPT,NDCH                                     00001150
      NAMELIST/IN3/DAY,THR,TMIN,TSEC,AMDA0,BGT0,DAMDA,DT,CHR                    00001160
      NAMELIST/IN4/W0,E0,ANCL,ASMTH,RA1,W1,E1,A0,A1                             00001170
      NAMELIST/IN5/X_AT,XLONG,AD,AZTH,ALTH,AL0,XLAT1,XONG1,                     00001180
     *TDELAY                                                                    00001190
      LOGICAL SL1                                                               00001200
      DATA EST,EDT/4H EST,4H EDT/,XRLY,XLTE/5HEARLY,4HLATE/                     00001210
      DATA BLANK/6H      /                                                      00001220
    1 CALL CLEAR(TM,INDX)                                                       00001230
      DO 99 II=1,24                                                             00001240
      HED(II)=BLANK                                                             00001250
   99 CONTINUE                                                                  00001260
      PI = 3.1415926536                                                         00001270
      RAD =  .0174532925                                                        00001280
      SL1 =.FALSE.                                                              00001290
      AB = 6378.174                                                             00001300
    2 READ(05,IN1,END=999)                                                      00001310
C                                                                               00001320
      READ(05,IN2)                                                              00001330
C                                                                               00001340
C                                                                               00001350
C                 NAME_IST - IN2                                                00001360
C                                                                               00001370
C     NRUN = RUN NUMBER ASSIGNED TO PASS                                        00001380
C     NPRLX = IF NOT 0 ,PUNCHED PAPER TAPE FOR PARALLEX                         00001390
C             CORRECTION OF TRANSPORTABLE STATION WILL BE COMPUTED              00001400
C     NDL = NUMBER OF PASSES TO BE COMPUTED, FIRST THE ON TIME                  00001410
C             PASS, THEN ONE FOR LAMDA+ DELTALAMDA, THEN LAMDA- DELTALAMDA,     00001420
C             LAMDA+2DELTALAMDA, THEN LAMDA- 2DELTALAMDA. NORMALLY USE 2        00001430
C     NOPT = 0, SUBROUTINE OUT 3 IS NOT CALLED.                                 00001440
C     NOPT = ANY OTHER NUMBER, SUBROUTINE OUT3 IS CALLED                        00001450
C      ALSO SUBROUTINE OUT4 IS CALLED FOR PLOTTING                              00001455
C                                                                               00001460
      READ(05,IN3)                                                              00001470
C                                                                               00001480
C                                                                               00001490
C                 NAME_IST - IN3                                                00001500
```

```
C                                                                       00001510
C     DAY = DAY OF YEAR          NODAL CROSSING TIME                    00001520
C     THR = HOUR OF DAY          NODAL CROSSING TIME                    00001530
C     TMIN = MIN. OF HOUR        NODAL CROSSING TIME                    00001540
C     TSEC = SEC. OF MIN.        NODAL CROSSING TIME                    00001550
C     AMDAD = LONGITUDE OF NODAL CROSSING                               00001560
C     BGTO = EPOCH TIME OF NODAL CROSSING                               00001570
C     DAMDA = DELTA LAMDA (-.5DEGREES IS 2 MIN? EARLY PASS,             00001580
C           WHICH IS NORMALLY THE SECOND PASS                           00001590
C     DT = 30.0, THE INTERVAL IN SECONDS BETWEEN COMPUTATIONS           00001600
C     CHR = 4.0 IF CONVERTING GMT TO EDT                                00001610
C     BHR = 5.0 IF CONVERTING GMT TO EST                                00001620
C                                                                       00001630
      READ(05,IN4)                                                      00001640
C                                                                       00001650
C                                                                       00001660
C                NAME_IST - IN4                                         00001670
C                                                                       00001680
C     WO = ARGUMENT OF PERIGEE, DEGREES                                 00001690
C     EO = ORBIT ECCENTRICITY                                           00001700
C     ANCL = ORBIT INCLINATION, DEGREES                                 00001710
C     ANMTH = A, MEAN MOTION, REVOLUTIONS/DAY                           00001720
C     DA1 = RATE OF CHANGE OF RIGHT ASCENDING NODE, DEGREES/DAY         00001730
C     WE = RATE OF CHANGE OF ARGUMENT OF PERIGEE IN DEGREES / DAY       00001740
C     EE = RATE OF CHANGE OF ECCENTRICITY, PER DAY                      00001750
C     AO = SEMIMAJOR AXIS OF ORBIT IN EARTH RADII                       00001760
C     AE = RATE OF CHANGE OF AO IN EARTH RADII/DAY                      00001770
C                                                                       00001780
      READ(05,IN5)                                                      00001790
C                                                                       00001800
C                                                                       00001810
C                NAME_IST - IN5                                         00001820
C                                                                       00001830
C     RLAT = LATITUDE OF RADAR                                          00001840
C     RLONG = LONGITUDE OF RADAR                                        00001850
C     AD = EARTHS RADIUS AT RADAR IN KM                                 00001860
C     AZTH = MAXIMUM ALLOWED AZIMUTH DEVIATION OF BEAM                  00001870
C          CENTER FROM SATELLITE POSITION                               00001880
C     ALTH = MAXIMUM ALLOWED ELEVATION DEVIATION OF BEAM                00001890
C          CENTER FROM SATELLITE POSITION                               00001900
C     ALO = INITIAL ELEVATION ANGLE OF THE PASS                         00001910
C     RLAT1 = TRANSPORTABLE STATION LOCATION, LATITUDE                  00001920
C     RLONG1 = TRANSPORTABLE STATION LOCATION, LONGITUDE                00001930
C     TDELAY = TRANSMITTER TIME DELAY, USED TO COMPUTE THE RANGE        00001940
C              MARK NUMBER( A NUMBER THAT DESCRIBES THE SETTING OF      00001950
C              5 SWITCHES AT TRANSMITTER TO  GET A PROPERLY TIMED       00001960
C              RANGE MARK FOR STARTING THE PASS).                       00001970
      TMTP = EST                                                        00001980
      IF (CHR.EQ.4.0) TMTP = EDT                                        00001990
      NDL = MIN0(NDL,5)                                                 00002000
      TO = 3600.0*THR+60.0*TMIN+TSEC                                    00002010
      DTO = DAY*(THR*CHR)/24.0+TMIN/1440.0+TSEC/86400.0-BGTO            00002020
```

```
      AMDA1 = 360.985-RA1                                                00002030
C     86400 = SECONDS IN A DAY                                           00002040
      P = 86400.0/ASMTH                                                  00002050
    3 SANCL = SIN (ANCL*RAD)                                             00002060
      CANCL = COS (ANCL*RAD)                                             00002070
      SLAT = SIN (XLAT*RAD)                                              00002080
      CLAT = COS (XLAT*RAD)                                              00002090
    4 BLONG = XLONG*RAD                                                  00002100
      SLAT1 = SIN(XLAT1*RAD)                                             00002110
      CLAT1 = COS(XLAT1*RAD)                                             00002120
      BLONG1 = XLONG1*RAD                                                00002130
      RAMDA = AMDA1*RAD/86400.0                                          00002140
      RW1 = W1*RAD/86400.0                                               00002150
      L = 1                                                              00002160
      M = 1                                                              00002170
    5 T = T0                                                             00002180
      E = E0+CT0*E1                                                      00002190
      AMDA = AMDA0                                                       00002200
      W = W0+W1*CT0+720.0                                                00002210
      A = AB*(A0+CT0*A1)                                                 00002220
      W = AMOD(W,360.0)                                                  00002230
      RW = W*RAD                                                         00002240
      CP0 = (E+COS (RW))/(1.0+E*COS (RW))                                00002250
      SP0 = SIGN (SQRT (1.0-CP0**2),SIN (RW))                            00002260
      IF(CP0)501,500,502                                                 00002270
  500 PHI0 = SP0*PI/2.0-PI                                               00002280
      GO TO 503                                                          00002290
  501 PHI0 = -PI+ATAN(SP0/CP0)                                           00002300
      GO TO 503                                                          00002310
  502 PHI0 = -AMOD(ATAN(SP0/CP0)+2.0*PI,2.0*PI)                          00002320
  503 CON= E*SP0+PHI0                                                    00002330
    6 XLAM(1) = AMDA*RAD                                                 00002340
      XLAM(2) = (AMDA+DAMDA)*RAD                                         00002350
      XLAM(3) = (AMDA-DAMDA)*RAD                                         00002360
      XLAM(4) = (AMDA+2.0*DAMDA)*RAD                                     00002370
      XLAM(5) = (AMDA-2.0*DAMDA)*RAD                                     00002380
    7 TM(L) = T                                                          00002390
      V = 2.0*PI*(T-T0)/P+CON                                            00002400
      IF(V.NE.0.0)GO TO 9                                                00002410
    8 PHI(L) = 0.0                                                       00002420
      GO TO 10                                                           00002430
    9 PHIG = V/(1.0-E)                                                   00002440
      CALL NEWT(PHIG,PHI(L),E,V)                                         00002450
   10 SPHI = SIN (PHI(L))                                                00002460
      CTH = (COS (PHI(L))-E)/(1.0-E*COS (PHI(L)))                        00002470
      STH = SIGN ((SQRT (1.0-CTH**2)),SPHI)                              00002480
      IF(CTH) 12,11,12                                                   00002490
   11 TM = PI-STH*PI/2.0                                                 00002500
      GO TO 17                                                           00002510
   12 TM = ATAN (STH/CTH)                                                00002520
      IF(TH) 13,13,16                                                    00002530
   13 TM = PI*(1.0-CTH) / 2.0                                            00002540
```

```
      IF(TH-THETA(L-1)) 14,17,17                                        00002550
   14 TH = 2.0*PI                                                       00002560
      GO TO 17                                                          00002570
   15 TH = TH + 1.5*PI*SIGN ((PI/2.0),CTH)                              00002580
      GO TO 17                                                          00002590
   16 TH = TH+PI/2.0*SIGN ((PI/2.0),CTH)                                00002600
   17 THETA(L) = TH                                                     00002610
      RHO(L) = A*(1.0-E*COS (PHI(L)))                                   00002620
      D(L) = RW*RW1*(T-T0)*THETA(L)                                     00002630
   18 DELL = XLAM(M)-RLONG+RAMDA*(TM(L)-T0)                             00002640
      CD = COS (D(L))                                                   00002650
      SD = SIN (D(L))                                                   00002660
      CDL= COS (DELL)                                                   00002670
      SDL = SIN (DELL)                                                  00002680
      CD = 0                                                            00002690
      IF(CD) 181,180,181                                                00002700
  180 X = SIGN (PI/2.0,CANCL*SD)                                        00002710
      GO TO 182                                                         00002720
  181 X = ATAN (CANCL*SD/CD)                                            00002730
  182 IF(X*CANCL)183,19,19                                              00002740
  183 X = X-SIGN (PI,X)                                                 00002750
   19 COSE = SANCL*SLAT*SD+CLAT*CDL*CD+CANCL*CLAT*SDL*SD                00002760
      SINE = SQRT (1.0-COSE**2)                                         00002770
      IF(SINE.NE.0.0)GO TO 20                                           00002780
      TANALF = 10.0E+30                                                 00002790
      GO TO 21                                                          00002800
   20 TANALF = (COSE-AD/RHO(L))/SINE                                    00002810
   21 IF(TANALF) 22,25,25                                               00002820
   22 IF(SL1)GO TO 35                                                   00002830
   23 IF(M-1) 24,24,26                                                  00002840
   24 T = T+DT                                                          00002850
      GO TO 7                                                           00002860
   25 SL1 =.TRUE .                                                      00002870
   26 RSQ = AD**2+RHO(L)**2-2.0*AD*RHO(L)*COSE                          00002880
      IF(SINE) 28,27,28                                                 00002890
   27 COSAZ = 1.0                                                       00002900
      GO TO 29                                                          00002910
   28 COSAZ = (SANCL*SD-SLAT*COSE)/(CLAT*SINE)                          00002920
   29 SINAZ = SIGN (SQRT (1.0-COSAZ**2),(X-DELL))                       00002930
      IF(COSAZ) 31,30,31                                                00002940
   30 TAZ = SINAZ*PI/2.0                                                00002950
      GO TO 322                                                         00002960
   31 TAZ = ATAN (SINAZ/COSAZ)                                          00002970
      IF(TAZ) 320,32,321                                                00002980
   32 TAZ = PI*(1.0-COSAZ)/2.0                                          00002990
      GO TO 322                                                         00003000
  320 TAZ = TAZ+1.5*PI+SIGN ((PI/2.0),COSAZ)                            00003010
      GO TO 322                                                         00003020
  321 TAZ = TAZ+PI/2.0-SIGN ((PI/2.0),COSAZ)                            00003030
  322 AZ(L) = TAZ/RAD                                                   00003040
      ALPH(L) = ATAN (TANALF)/RAD                                       00003050
      R(L) = SQRT (RSQ)                                                 00003060
```

```
 33 L = L+1                                                          00003070
    IF(M.LE.1)GO TO 34                                               00003080
    IF(TM(L).EQ.TM(L-1)+DT)GO TO 18                                  00003090
 34 T = T+DT                                                         00003100
    GO TO 7                                                          00003110
 35 BL1 =.FALSE.                                                     00003120
    AMBA = XLAM(M)/RAD                                               00003130
    EARLY = (AMBA-AMDA0)*4.0                                         00003140
    NERLY = EARLY+SIGN(.5,EARLY)                                     00003150
    NERL = IABS(NERLY)                                               00003160
    CTIME = XRLY                                                     00003170
    IF (NERLY.GT.0) CTIME = XLTE                                     00003180
    CALL OUT1                                                        00003190
    CALL OUT2                                                        00003200
    IF (NOPT.NE.0) CALL OUT3                                         00003210
    IF(NOPT.NE.0)CALL OUT4                                           00003215
    IF(NPRLX.NE.0)CALL PARALX                                        00003220
    IF(M.GE.NDL)GO TO 1                                              00003230
    M = M+1                                                          00003240
    L = 1                                                            00003250
    GO TO 18                                                         00003260
999 CONTINUE                                                         00003270
    STOP                                                             00003280
    END                                                              00003290
```

```
C
C OUT1   ORBIT PREDICTION PROGRAM-SUBROUTINE OUT1                       000033
C                                                                       000033 5
      SUBROUTINE OUT1                                                   0000331
      DIMENSION TM(15  ),AZ(15  ),ALPH (1500),R(1500),PHI(1500),        0000332
     1          THETA(15  0),RHO(15  ),D(1500),ECP(750),ACP(750),      0000333
     2          HED(24),XLAM(5),ICP(750)                               0000334
      COMMON TM,AZ,ALPH,R,PHI,THETA,RHO,D,ECP,ACP,XXX,HED,XLAM,T0,DT,   0000335
     1       CT ,AMDA ,AMDA1,DAMDA,W0,W1,E0,E1,ANCL,A,P,XLAT,XLONG,AD,  0000336
     2       SANCL,CANCL,SLAT,CLAT,RLONG,L,M,J,T,W,AMDA,AMBA,E,V,PHIG,  0000337
     3       CTH,TH,DELL,SD,CD,CDL,SDL,COSE,SINE,TANALF,RSQ,COSAZ,TAZ,  0000338
     4       NN,N1,N2,XW,XL,XE,RAMDA,EW,CP0,PHI0,SP0,STH,X,SINAZ,RW1,   0000339
     5       SPHI,CON,AZTH,ALTH,AL ,I,IALS,JJ,KK,NO2,OPT,DELN,GAMN,     0000340
     6       MMIN,MSEC,DPLR,DEN,DFN,TT,MHR,HR,IMIN,YMIN,ISEC,TMIN,J1    0000341
      COMMON NRUN,NPRLX,NDL,NOPT,NDCH,DAY,THR,TSEC,AZMTH,CHR,PI,RA1,    0000342
     1       RAD,NA,NB,NC,ND,NE,RRATE,BGT0,A0,A1,XLAT1,XLONG1,TDELAY,   0000343
     2       DOPLER,N,TNDX,TMTP,NERL,CTIME,ASMTH,RLONG1,SLAT1,CLAT1     0000344
    1 NN = L-1                                                          0000345
      DO 2 I=1,NN                                                       0000346
      IF (ALPH(I).LT.AL ) GO TO 2                                       0000347
      IALS = I                                                          0000348
      GO TO 3                                                           0000349
    2 CONTINUE                                                          000035
      WRITE(6,1   ) (HED(I),I=1,24),NRUN,M,TMTP,AMBA,BGT0,NERL,CTIME    000351
 1000 FORMAT(1H1,29X12A6/3 X12A6 / 2X7HRUN NO.I6,4H-I1,2X11HRISE TIME -  0000352
     1       3X5H HRS.3X5H MIN.3X6H SEC. A4,2X8HLAMBDA =F8.3,5H DEG.    0000353
     2       2X12HEPOCH TIME =F8.3,5H DAYS ,2XI3,6H MIN. A6,4HPASS //   0000354
     3       5 X32HORBIT NOT HIGH ENOUGH TO BE SEEN)                    0000355
      NOPT = 1                                                          0000356
      RETURN                                                            0000357
    3 DOPLER = 9.*(R(IALS-1)-R(IALS+1))/(TM(IALS+1)-TM(IALS-1))         0000358
      RRATE = .35*DOPLER                                                0000359
      N = R(IALS)/.15+TDELAY                                            000036
      NA = N/1                                                          0000361
      IB = N-1   *NA                                                    0000362
      NB = (IB+1    )/2    +1                                           0000363
      IC = IB-NB*2  0+3   0                                             0000364
      IF (NB.GE.4) GO TO 4                                              0000365
      NB = IB/2                                                         0000366
      IC = IB-NB*2  0                                                   0000367
    4 NC = IC/25                                                        0000368
      IC = IC-25 *NC                                                    0000369
      ND = IC/32                                                        000037
      IC = IC-32*ND                                                     0000371
      NE = IC/4                                                         0000372
    5 JJ = 1                                                            0000373
      KK = IALS+2                                                       0000374
    6 DO 7  I=KK,NN,2                                                   0000375
      NO2 = (I+KK)/2-1                                                  0000376
      DELN = ALPH(NO2)-(ALPH(I)+ALPH(KK-2))/2.0                         0000377
      IF (ABS(DELN).GT.ALTH) GO TO 8                                    0000378
      GAMN = AZ(NO2)-(AZ(I)+AZ(KK-2))/2.0                               0000379
      IF (ABS(GAMN).GE.150.0) GAMN = GAMN-SIGN(180.0,GAMN)              0000380
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      IF (ABS(GAMN).GT.AZTH/COS(RAD*ALPH(NO2))) GO TO 8                 0000381
    7 CONTINUE                                                          0000382
      JJ = JJ-1                                                         0000383
      GO TO 9                                                           0000384
    8 ICP(JJ) = I                                                       0000385
      DEN = 3.0*(ALPH(I)-ALPH(KK-2))                                    0000386
      ACP(JJ) = 1000.0*DT*FLOAT(I-KK+2)/DEN                             0000387
      DFN = 3.0*(AZ(I)-AZ(KK-2))                                        0000388
      IF (ABS(DFN).GE.900.) DFN = DFN-SIGN(1080.0,DFN)                  0000389
      ACP(JJ) = 1000.0*DT*FLOAT(I-KK+2)/DFN                             0000390
      JJ = JJ+1                                                         0000391
      KK = I+2                                                          0000392
      GO TO 6                                                           0000393
    9 LLL  = 0                                                          0000394
      TT = TM(IALS)                                                     0000395
      MHR = TT/3600.0                                                   0000396
      HR = MHR                                                          0000397
      IMIN = ABS(TT-3600.0*HR)/60.0                                     0000398
      IMIN = IMIN                                                       0000399
      ISEC = ABS(TT-3600.0*HR-60.0*YMIN)                                0000400
      MMIN = 0                                                          0000401
      MSEC = 0                                                          0000402
      INDX = IALS                                                       0000403
      MELD = ALPH(INDX)                                                 0000404
      MELM = (ALPH(INDX)-FLOAT(MELD))*60.0+.5                           0000405
      IF(MELM.LT.60)GO TO 90                                            0000406
      MELD = MELD+1                                                     0000407
      MELM = MELM-60                                                    0000408
   90 MAZD = ABS(AZ(INDX))                                              0000409
      MAZM = (ABS(AZ(INDX))-FLOAT(MAZD))*60.0+.5                        0000410
      IF(MAZM.LT.60)GO TO 91                                            0000411
      MAZD = MAZD+1                                                     0000412
      MAZM = MAZM-60                                                    0000413
   91 MAZD = ISIGN(MAZD,AZ(INDX))                                       0000414
      RM = R(INDX)/6076.                                                0000415
   10 IF(MOD(LLL,27).NE.0)GO TO 11                                      0000416
      WRITE(6,1001)(HED(I),I=1,24),NRUN,M,MHR,IMIN,ISEC,TMTP,AMBA,BGTO, 0000417
     1              NERL,CTIME                                          0000418
 1001 FORMAT(1H1,29X12A6/3 X12A6 / 2X7HRUN NO.I6,1H-I1, 2X11HRISE TIME -0000419
     1       I3,5H HRS.I3,5H MIN.I3,5H SEC. A4, 2X8HLAMBDA =F8.3,5H DEG.0000420
     2        2X12HEPOCH TIME =F8.3,5H DAYS, 2XI3,6H MIN. A6,4HPASS//  0000421
     3       7X4HTIME,1 X9HELEVATION,10X7HAZIMUTH,9X9HEL. ANGLE,7X     0000422
     4        9HAZ. ANGLE, 9X5HRANGE,15X7HDOPPLER 7X4HTIME/5X9HMIN. SEC.0000423
     5        7X11HCNTG. PER.,8X11HCNTG. PER.,7X9HDEG. MIN.,7X9HDEG. MIN.0000424
     6        6X3HKM.6X3HMS.,13X4HK.C.,7X9HMIN. SEC. )                  0000425
      IF (LLL.EQ.0)WRITE(6,1002)MMIN,MSEC,MELD,MELM,MAZD,MAZM,R(INDX),  0000426
     1             RM,DOPLER                                            0000427
 1002 FORMAT(I8,I4,I7,I5,I12,I4,F13.3,F9.3,F16.3)                       0000428
   11 LLL = LLL+1                                                       0000429
      INDX1 = INDX                                                      0000430
      INDX = ICP(LLL)                                                   0000431
      DOPLER = 9.*(R(INDX1)-R(INDX))/(TM(INDX)-TM(INDX1))               0000432
```

```
      MELD = ALPH(INDX)                                                  000433
      MELM = (ALPH(INDX)-FLOAT(MELD))*60.0+.5                            000434
      MAZD = ABS(AZ(INDX))                                               000435
      MAZM = (ABS(AZ(INDX))-FLOAT(MAZD))*60.0+.5                         000436
      MAZD = ISIGN(MAZD,AZ(INDX))                                        000437
      RM = R(INDX)/6076.                                                 000438
      TT = TM(INDX)-TM(IALS)                                             000439
      MMIN1 = TT/60.0                                                    000440
      ZMIN = MMIN1                                                       000441
      MSEC1 = ABS(TT-60.0*ZMIN)                                          000442
      MTMP = (60*(MMIN1+MMIN)+MSEC1+MSEC)/2                              000443
      MSEC2 = MOD(MTMP,60)                                               000444
      MMIN2 = (MTMP-MSEC2)/60                                            000445
      MMIN = MMIN1                                                       000446
      MSEC = MSEC1                                                       000447
      WRITE(6,1003)ECP(LLL),ACP(LLL),DOPLER,MMIN2,MSEC2,MMIN,MSEC,MELD, 000448
     1             MELM,MAZD,MAZM,R(INDX),RM                             000449
 1003 FORMAT(F29.,F18.,F71.3,I8,I4/I8,I4,I47,I5,I12,I4,F13.3,F9.3)       000450
      IF (LLL.LT.JJ) GO TO 10                                            000451
      RETURN                                                             000452
      END                                                                000453
```

```
COUT2   ORBIT PREDICTION PROGRAM-SUBROUTINE OUT2                        00004540
C                                                                       00004545
      SUBROUTINE OUT2                                                   00004550
      DIMENSION TM(1500),AZ(1500),ALPH(1500),R(1500),PHI(1500),         00004560
     1          THETA(1500),RHO(1500),D(1500),ECP(750),ACP(750),       00004570
     2          MED(24),XLAM(8)                                        00004580
      COMMON TM,AZ,ALPH,R,PHI,THETA,RHO,D,ECP,ACP,ICP,MED,XLAM,TO,DT,   00004590
     1       CT0,AMDA0,AMDA1,DAMDA,W0,W1,E0,E1,ANCL,A,P,XLAT,XLONG,AD,  00004600
     2       SANCL,CANCL,SLAT,CLAT,RLONG,L,M,J,T,W,AMDA,AMDA,E,V,PHIO,  00004610
     3       CTH,TH,DELL,SD,CD,CDL,SDL,COSE,SINE,TANALP,RSQ,COSAZ,TAZ,  00004620
     4       NN,N1,N2,RW,XL,XE,RAMDA,RW,CPO,PHIO,SPO,STH,X,SINAZ,RW1,   00004630
     5       SPHI,CON,XZTH,ALTH,ALO,I,IALS,JJ,KK,NO2,OPT,DELN,GAMN,     00004640
     6       MMIN,MSEC,DDLR,DEN,DYN,TT,MHR,HR,IMIN,YMIN,ISEC,TMIN,J1    00004650
      COMMON NRUN,NPRLX,NDL,NOPT,NDCH,DAY,THR,TSEC,AZMTH,CHR,PI,RA1,    00004660
     1       RAD,NA,NB,NC,ND,NE,RRATE,BGTO,A0,A1,XLAT1,XLONG1,TDELAY,   00004670
     2       DOPLER,N,INDX,TMTP,NERL,CTIME,ASMTH,RLONG1,SLAT1,CLAT1     00004680
    1 ELMLS = ALPH(IALS)*17.7778                                        00004690
      AZMLS = AZ(IALS)*17.7778                                          00004700
      NELD = ALPH(IALS)                                                 00004710
      NELM = (ALPH(IALS)-FLOAT(NELD))*60.0+.5                           00004720
      NAZD = ABS(AZ(IALS))                                              00004730
      NAZM = (ABS(AZ(IALS))-FLOAT(NAZD))*60.0+.5                        00004740
      NAZD = ISIGN(NAZD,AZ(IALS))                                       00004750
      RM = R(IALS)/1500.                                                00004760
    2 WRITE(6,1000)(MED(I),I=1,24)                                      00004770
 1000 FORMAT(1H1,29X12A6/3 X12A6 ///4)                                  00004780
      WRITE(6,1001)NRUN,M,NRUN,M,MHR,IMIN,ISEC,ALPH(IALS),MHR,IMIN,ISEC,00004790
     1             AZ(IALS),NELD,NELM,ELMLS,RM,NAZD,NAZM,AZMLS,R(IALS),  00004800
     2             RM,RRATE,NA,NB,NC,ND,NE                              00004810
 1001 FORMAT(29X8HRECORDER,58X8HDIRECTOR //10X4HDATE,62X4HDATE//10X      00004820
     1       11HPASS NUMBER,I8,1H-I1,45X11HPASS NUMBER,I8,1H-I1//10X    00004830
     2       9HRISE TIME,I3,5H HRS.,I3,5H MIN.,I3,5H SEC.,33X           00004840
     3       13HOBJECT NUMBER//10X14HRISE ELEVATION F7.3,8H DEGREES,37X 00004850
     4       9HRISE TIME,I3,5H HRS.,I3,5H MIN.,I3,5H SEC.//10X          00004860
     5       12HRISE AZIMUTH F9.3,8H DEGREES,37X14HRISE ELEVATION,I3,   00004870
     6       5H DEG.,I3,7H MIN. ,F10.5,5H MILS//10X11HRANGE AT TO,F10.5,00004880
     7       4H MS.,41X12HRISE AZIMUTH,I5,5H DEG.,I3,7H MIN. , F10.5,   00004890
     8       5H MILS//76X11HRANGE AT TO,F8.1,4H KM.,F10.5,4H MS.//76X   00004900
     9 16HRANGE RATE AT T0,F10.5,5H US/S//76X19HRANGE MARK NUMBER  5I1)  00004910
    3 WRITE(6,1002)NRUN,NPRLX,NDL,NOPT,NDCH,NRUN,M,DAY,THR,TMIN,TSEC,   00004920
     1         AMDA0,BGTO,DAMDA,DT,CHR,MHR,IMIN,ISEC,W0,E0,ANCL,ASMTH,RM, 00004930
     2         RA1,W1,E1                                                00004940
 1002 FORMAT(///////3 X7HTRACKER,57X11HINPUT CARDS //10X4HDATE,52X      00004950
     1       6HNRUN =I6, 9H  NPRLX =I6,7H  NDL =I4,8H  NOPT =I4,        00004960
     2      8H  NDCH =I6//10X8HPASS NO.I8,1H-I1,38X5HDAY =F5.0,7H  THR =00004970
     3       F4.0,8H  TMIN =F4.0,8H  TSEC =F4.0,9H  AMDA0 =F8.3//10X    00004980
     4       8HREEL NO.,52X6HBGTO =F9.4,9H  DAMDA =F7.3,6H  DT =F4.1,   00004990
     5       7H  CHR =F3.0//10X9HRISE TIME,I3,5H HRS.,I3,5H MIN.,I3,    00005000
     6       5H SEC.,23X4HW0 =F9.4,6H  E0 =F9.6,8H  ANCL =F7.3,         00005010
     7       9H  ASMTH =F9.5//71 X11HRANGE AT TO,F10.5,4H MS.,35X6H RA1 =00005020
     8       F9.5,6H  W1 =F9.5,6H  E1 =1PE12.4)                         00005030
    4 WRITE(6,1003)NA,NB,NC,ND,NE,A0,A1,RRATE,XLAT,XLONG,AD,AZTH,ALTH,  00005040
```

```
     1                AL ,XLAT1,XLONG1,TDELAY                                    00005050
1003 FORMAT(/1 X19HRANGE MARK NUMBER  5I1,37X4HAO =F9.5,6H  A1 =1PE12,4 00005060
     1       //10X16HRANGE RATE AT TO,0PF10.5,5H US/S,25X6HXLAT =F9.5,  00005070
     2       9H  XLONG =F9.5,6H  AD =F8.2,8H  AZTH =F7.3//10X8HNMBLIDIAL 00005080
     3       53X6HALTH =F6.3,7H  AL  =F5.1,9H  XLAT1 =F9.5,10H  XLONG1 =00005090
     4       F9.5//10X9HSTOP TIME,52X8HTDELAY =F7.2 )                   00005100
      RETURN                                                            00005110
      END                                                               00005120
```

```
COUT3   ORBIT PREDICTION PROGRAM-SUBROUTINE OUT3                                00005130
C                                                                               00005135
      SUBROUTINE OUT3                                                           00005140
      DIMENSION TM(1500),AZ(1500),ALPH (1500),R(1500),PHI(1500),                00005150
     1          THETA(1500),RHO(1500),D(1500),ECP(750),ACP(750),               00005160
     2          HED(24),XLAM(5)                                                00005170
      COMMON TM,AZ,ALPH,R,PHI,THETA,RHO,D,ECP,ACP,ICP,HED,XLAM,TO,DT,           00005180
     1       CTO,AMDA0,AMDA1,DAMDA,W0,W1,E0,E1,ANCL,A,P,XLAT,XLONG,AD,          00005190
     2       SANCL,CANCL,SLAT,CLAT,RLONG,L,M,J,T,W,AMDA,AMBA,E,V,PHIG,          00005200
     3       CTH,TH,DELL,SD,CD,CDL,SBL,COSB,SINE,TANALF,RSQ,COSAZ,TAZ,          00005210
     4       NN,N1,N2,XW,XL,XE,RAMDA,RW,CP0,PHI0,SP0,STH,X,SINAZ,RW1,           00005220
     5       SPHI,CON,AZTH,ALTH,AL0,I,IALS,JJ,KK,NO2,OPT,DELN,GAMN,             00005230
     6       MMIN,MSEC,DPLR,DEN,DFN,TT,MHR,HR,IMIN,YMIN,ISEC,TMIN,J1            00005240
      COMMON NRUN,NPRLX,NDL,NOPT,NDCH,DAY,THR,TSEC,AZMTH,CHR,PI,RA1,            00005250
     1       RAD,NA,NB,NC,ND,NE,RRATE,BGT0,A0,A1,XLAT1,XLONG1,TDELAY,           00005260
     2       DOPLER,N,INDX,TMTP,NERL,CTIME,ASMTH,RLONG1,SLAT1,CLAT1             00005270
    1 NSEC = TM(1)-TM(IALS)                                                     00005280
      IDT = DT                                                                  00005290
      N1 = 1                                                                    00005300
    2 N2=MIN0(N1+48,NN)                                                         00005310
      WRITE(6,1000) (HED(I),I=1,24),NRUN,M,NERL,CTIME,DAY,THR,TMIN,TSEC,        00005320
     1              AMBA,MHR,IMIN,ISEC,TMTP                                     00005330
 1000 FORMAT(1H1,29X12A6/30X12A6//5X8HPASS NO. I6,1H-I1,2H -,I2,6H MIN.         00005340
     1       A6//25X29HNODAL CROSSING DATA - DAY NO.,F4.0,2H ,F4.0,             00005350
     2       5H HRS.,F4.0,5H MIN.,F4.0,16H SEC. - LAMBDA = F9.3 //45X           00005360
     3       11HRISE TIME -I4,5H HRS.,I4,5H MIN.,I4,5H SEC.,A4 // 9X            00005370
     4       4HTIME,28X7HAZIMUTH,36X9HELEVATION,25X5HRANGE/9X4HSEC.,17X,        00005380
     5       7HDEGREES,15X7HRADIANS,15X7HDEGREES,15X7HRADIANS,16X3HKM, )        00005390
    3 DO 4  I=N1,N2                                                             00005400
      AZR = AZ(I)*RAD                                                           00005410
      ELR = ALPH(I)*RAD                                                         00005420
      WRITE(6,1001) NSEC,AZ(I),AZR,ALPH(I),ELR,R(I)                             00005430
 1001 FORMAT(I13,F24.3,F22.5,F21.3,F23.5,F21.2)                                 00005440
      NSEC = NSEC+IDT                                                           00005450
    4 CONTINUE                                                                  00005460
      N1 = N2+1                                                                 00005470
      IF(N1.LE.NN) GO TO 2                                                      00005480
      RETURN                                                                    00005490
      END                                                                       00005500
```

```
CPRLX   ORBIT PREDICTION PROGRAM-SUBROUTINE PARALX                              00005510
C                                                                               00005515
      SUBROUTINE PARALX                                                         00005520
      DIMENSION TM(1500),AZ(1500),ALPH (1500),R(1500),PHI(1500),                00005530
     1          THETA(1500),RHO(1500),D(1500),ECP(750),ACP(750),               00005540
     2          HED(24),XLAM(5)                                                00005550
      COMMON TM,AZ,ALPH,R,PHI,THETA,RHO,D,ECP,ACP,ICP,HED,XLAM,TO,DT,           00005560
     1       CTO,AMDA0,AMDA1,DAMDA,W0,W1,E0,E1,ANCL,A,P,XLAT,XLONG,AD,          00005570
     2       SANCL,CANCL,SLAT,CLAT,RLONG,L,M,J,TW,AMDA,AMBATE,V,PHIG,           00005580
     3       CTH,TH,DELL,SD,CD,CDL,SDL,COSE,SINE,TANALF,RSQ,COSAZ,TAZ,          00005590
     4       NN,N1,N2,XW,XL,XE,RAMDA,RW,CPO,PHIO,SPO,STH,X,SINAZ,RW1,           00005600
     5       SPHI,CON,AZTH,ALTH,ALO,I,IALS,JJ,KK,N02,OPT,DELN,GAMN,             00005610
     6       MMIN,MSEC,DPLR,DEN,DFN,TTIMHR,HR,IMIN,YMIN,ISEC,TMIN,J1            00005620
      COMMON NRUN,NPRLX,NDL,NOPT,NDCH,DAY,THR,TSEC,AZMTH,CHR,PI,RA1,            00005630
     1       RAD,NA,NB,NC,ND,NE,RRATE,BGTO,A0,A1,XLAT1,XLONG1,TDELAY,           00005640
     2       DOPLER,V,INDX,TMTP,NERL,CTIME,ASMTH,RLONG1,SLAT1,CLAT1             00005650
      DIMENSION PAZ(600),PEL(600),EL(3750),AZ1(3750)                            00005660
      EQUIVALENCE (EL,AZ),(AZ1,R(751))                                          00005670
      APT = 6.25*DT                                                             00005680
      NPT = XPT                                                                 00005690
      XTRA = XPT-FLOAT(NPT)                                                     00005700
      NX = 4000                                                                 00005710
      IF(XTRA.NE.0.0) NX = 1.0/XTRA+.3                                          00005720
      IDT = DT                                                                  00005730
      LT = L-1                                                                  00005740
      JTOT = L-IALS                                                             00005750
      IF(JTOT*IDT.LE.600) GO TO 1                                               00005760
      WRITE(6,1000) NRUN,M                                                      00005770
 1000 FORMAT(9HOPASS NO. I7,1H-I1,23H LONGER THAN 10 MINUTES)                   00005780
      JTOT = 600/IDT                                                            00005790
      LT = IALS+JTOT-1                                                          00005800
    1 DO 3  I=IALS,LT                                                           00005810
      J = I-IALS+1                                                              00005820
      TCON = TM(I)-TO                                                           00005830
      DELL = XLAM(M)+RLONG1+RAMDA*TCON                                          00005840
      SD = COS(D(I))                                                            00005850
      SD = SIN(D(I))                                                            00005860
      CDL = COS(DELL)                                                           00005870
      SDL = SIN(DELL)                                                           00005880
      R = ATAN2(CANCL*SD,CD)                                                    00005890
    2 COSE = SANCL*SLAT1*SD+CLAT1*CDL*CD+CANCL*CLAT1*SDL*SD                     00005900
      SINE = SQRT(1.0-COSE**2)                                                  00005910
      PEL(J) = ALPH(I)-ATAN2(COSE-AD/RHO(I),SINE)/RAD                           00005920
      COSAZ = 1.0                                                               00005930
      IF (SINE.NE.0.0) COSAZ = (SANCL*SD-SLAT1*COSE)/(CLAT1*SINE)               00005940
      SINAZ = SIGN(SQRT(1.0-COSAZ**2),RX-DELL))                                 00005950
      PAZ(J) = AZ(I)-ATAN2(SINAZ,COSAZ)/RAD                                     00005960
      IF(ABS(PAZ(J)).GT.180.0)PAZ(J) = PAZ(J)-SIGN(360.0,PAZ(J))                00005970
    3 CONTINUE                                                                  00005980
      JT = JTOT-1                                                               00005990
      R = 0                                                                     00006000
      T11 = TM(IALS)                                                            00006010
```

```
    4 DO 7  I=1,JT                                                    00006020
      J = I+IALS-1                                                    00006030
      T1 = TM(J)                                                      00006040
      T2 = T1+DT                                                      00006050
      DELAZ = (PAZ(I+1)-PAZ(I))/DT                                    00006060
      DELEL = (PEL(I+1)-PEL(I))/DT                                    00006070
      NPT1 = NPT                                                      00006080
      IF(MOD(I,NX).EQ.0) NPT1 = NPT1+1                                00006090
    5 DO 6  J=1,NPT1                                                  00006100
      K = K+1                                                         00006110
      T12 = T11+.08                                                   00006120
      AZ1(K) = PAZ(I+1)-(T2-T11)*DELAZ                                00006130
      EL(K) = PEL(I+1)-(T2-T12)*DELEL                                 00006140
      T21 = T12+.08                                                   00006150
      IF(T11.GE.T2)GO TO 7                                            00006160
    6 CONTINUE                                                        00006170
    7 CONTINUE                                                        00006180
      WRITE(1)NRUN,M,K,MHR,IMIN,ISEC,AMBA                             00006190
      WRITE(1)(AZ1(I),EL(I),I=1,K)                                    00006200
      RETURN                                                          00006210
      END                                                             00006220
```

```
C NEWT   SATELLITE PREDICTION PROGRAM-SUBROUTINE NEWT 4/26/63                00006230
C                                                                            00006235
C     SOLUTION OF EQUATION - Q*X-P*SIN(X) - BY NEWTON-RAPHSON METHOD         00006240
C                                                                            00006245
      SUBROUTINE NEWT(X,Y,P,Q)                                               00006250
C     X = INITIAL GUESS                                                      00006260
C     Y = SOLUTION                                                           00006270
    1 NC = 0                                                                 00006280
      Y = X                                                                  00006290
    2 FX = X-P*SIN(X)-Q                                                      00006300
      FPX = 1.0-P*COS(X)                                                     00006310
      H = FX/FPX                                                             00006320
    3 X = X-H                                                                00006330
    4 IF(ABS(H/X)-.000001) 7,7,5                                             00006340
    5 NC = NC+1                                                              00006350
      IF(NC-50) 6,2,6                                                        00006360
    6 CONTINUE                                                               00006370
      GO TO 2                                                                00006380
    7 Y = X                                                                  00006390
      RETURN                                                                 00006400
      END                                                                    00006410
```

```
*                    SUBROUTINE CLEAR                                    00001000
*          SUBROUTINE TO SET FORTRAN LOCATIONS TO ZERO                   00001010
*          CALLING SEQUENCE - CALL CLEAR(X,Y)                            00001020
*                                                                        00001030
*THE PURPOSE OF CLEAR IS TO ZERO OUT LOCATIONS X THROUGH Y               00001040
 CLEAR  SAVE    1,4                                                      00001050
        LDA     2,1             ADDRESS OF X INTO A REGISTER             00001060
        SBA     3,1             ADDRESS OF Y                             00001070
        TPL     ORDER           Y IS GREATER THAN X                      00001080
        LDX4    2,1             RESTORE X4                               00001090
 A2     STZ     0,4                                                      00001100
        AAX4    1,4             INCRE X4                                 00001110
 A1     CMPX4   3,1                                                      00001120
        TNC     A2                                                       00001130
        TZE     A2                                                       00001140
        RETURN  CLEAR                                                    00001150
 ORDER  LDX4    3,1             REORDER                                  00001160
        LDQ     -1,DU                                                    00001170
        ASQ     A1              CHANGE A1 TO CMPM 2,1                    00001180
        TRA     A2                                                       00001190
        END                                                              00001200
```

```
COUT4    ORBIT PREDICTION PROGRAM-SUBROUTINE OUT4                          00000050
C                                                                          00000055
      SUBROUTINE OUT4                                                      00000060
      DIMENSION TM(1500),AZ(1500),ALPH (1500),R(1500),PHI(1500),           00000070
     1          THETA(1500),RHO(1500),D(1500),BCP(750),ACP(750),           00000080
     2          HED(24),XLAM(5)                                            00000090
      COMMON TM,AZ,ALPH,R,PHI,THETA,RHO,D,BCP,ACP,ICB,HED,XLAM,T0,DT,      00000100
     1       CT0,AMDA0,AMDA1,DAMDA,W0,W1,E0,E1,ANCL,A,P,XLAT,XLONG,AD,      00000110
     2       SANGL,CANCL,SLAT,CLAT,RLONG,L,M,J,T,W,AMDA,AMBA,E,V,PHIB,      00000120
     3       CTH,TH,DELL,SD,CD,CDL,SDL,COSE,SINE,TANALF,RSQ,COSAZ,TAZ,      00000130
     4       NN,N1,N2,XW,XL,XE,RAMDA,RW,CP0,PHI0,SR0,STH,X,SINAZ,RW1,       00000140
     5       SPHI,CON,AZTH,ALTH,AL0,I,IALS,JJ,KK,NO2,OPT,DELN,GAMN,         00000150
     6       MMIN,MSEC,DPLR,DEN,DFN,TT,MHR,IHR,IMIN,YMIN,ISEC,TMIN,J1       00000160
      COMMON NRUN,NPRLX,NDL,NOPT,NDCH,DAY,THR,TSEC,AZMTH,CHR,PI,RA1,       00000170
     1       RADYNA,NB,NC,ND,NE,RRATE,BGT0,A0,A1,XLAT1,XLONG1,TDELAY,       00000180
     2       DOPLER,N,INDX,TMTP,NERL,CTIME,ASMTH,RLONG1,SLAT1,CLAT1         00000190
      IF(NN.EQ.0)RETURN                                                    00000200
    1 NSEC = TM(1)-TM(IALS)                                                00000210
      IDT=DT                                                               00000220
      REWIND 2                                                             00000230
      WRITE(02)NSEC,IDT,NN                                                 00000240
      WRITE(02)(R(IP),IP=1,NN)                                             00000250
      WRITE(02)(AZ(IP),IP=1,NN)                                            00000260
      WRITE(02)(ALPH(IP),IP=1,NN)                                          00000270
      RETURN                                                               00000280
      END                                                                  00000290
***EOF                                                                     00000310
```

Sample Output for the Orbit Prediction Program

ORBIT PREDICTION PROGRAM

1 MIN EARLY OBJECT NO. 2108 BLTN NO. 7 4/1/66

RUN NO. 302-1 RISE TIME - 12 HRS. 4 MIN. 47 SEC. EDT LAMBDA = 96.109 DEG. EPOCH TIME = 66.018 DAYS 0 MIN. EARLY PASS

TIME MIN.	TIME SEC.	ELEVATION CNTG. PER.	AZIMUTH CNTG. PER.	EL. ANGLE DEG.	EL. ANGLE MIN.	AZ. ANGLE DEG.	AZ. ANGLE MIN.	RANGE KM.	RANGE MS.	DOPPLER K.C.	TIME MIN.	TIME SEC.
0	0			0		352	32	2031.203	13.541	-0.873		
		5055.	3092.							120.148	0	20
0	40			2	38	356	51	1778.261	11.895			
		4539.	2440.							115.163	0	55
1	10			4	51		56	1596.423	10.643			
		4116.	1951.							108.926	1	25
1	40			7	16	6	4	1424.434	9.496			
		3758.	1536.							100.032	1	55
2	10			9	56	12	35	1266.489	8.443			
		3557.	1251.							89.865	2	20
2	30			11	48	17	54	1171.894	7.813			
		3521.	1062.							79.188	2	40
2	50			13	42	24	11	1088.538	7.257			
		3685.	910.							65.863	3	0
3	10			15	31	31	30	1019.209	6.795			
		4254.	796.							49.656	3	20
3	30			17	5	39	53	966.939	6.446			
		6769.	708.							25.543	3	45
4	0			18	33	54	1	926.608	6.177			
		643377.	680.							-6.385	4	15
4	30			18	34	68	44	936.690	6.245			
		-7273.	737.							-37.290	4	45
5	0			17	12	82	18	995.569	6.637			
		-4669.	849.							-59.432	5	10
5	20			15	46	9	9	1058.128	7.054			
		-4093.	983.							-73.810	5	30
5	40			14	8	96	56	1135.823	7.572			
		-3928.	1154.							-85.409	5	50
6	0			12	26	102	43	1225.727	8.172			
		-3998.	1418.							-96.468	6	15
6	30			9	56	109	46	1378.044	9.187			
		-4269.	1811.							-106.110	6	45
7	0			7	36	115	18	1545.585	10.304			
		-4644.	2282.							-112.816	7	15
7	30			5	27	119	41	1723.716	11.491			
		-5130.	2919.							-118.108	7	50
8	10			2	51	124	15	1972.364	13.149			
		-5693.	3770.							-122.086	8	30
8	50			0	3	127	47	2229.388	14.863			
		-6633.	-26.							4235.837	8	55
9	0			0			0	0.	0.			

ORBIT PREDICTION PROGRAM

1 MIN EARLY OBJECT NO. 2108 BLTN NO. 7 4/1/66

RECORDER

DATE

PASS NUMBER 302-1

RISE TIME 12 HRS, 4 MIN, 47 SEC.

RISE ELEVATION 0.003 DEGREES

RISE AZIMUTH 352.53 DEGREES

RANGE AT TO 13.54135 MS.

DIRECTOR

DATE

PASS NUMBER 302-1

OBJECT NUMBER

RISE TIME 12 HRS, 4 MIN, 47 SEC.

RISE ELEVATION 0 DEG, 0 MIN, , 0.04861 MILS

RISE AZIMUTH 352 DEG, 32 MIN, .6267.21478 MILS

RANGE AT TO 2031.2 KM. 13.54135 MS.

RANGE RATE AT TO -0.30566 US/S

RANGE MARK NUMBER 11620

TRACKER

DATE

PASS NO. 302-1

REEL NO.

RISE TIME 12 HRS. 4 MIN. 47 SEC.

RANGE AT TO 13.54135 MS.

RANGE MARK NUMBER 1162

RANGE RATE AT TO -0.3 566 US/S

HELIDIAL

STOP TIME

INPUT CARDS

NRUN = 302 NPRLX = 0 NDL = 1 NOPT = 10 NDCH = -10

DAY = 91. THR = 8. TMIN = 32. TSEC = 57. AMDA0 = 96.100

BGT0 = 86.0184 DAMDA = 0. DT = 5.0 CHR = 4.

W0 = 58.0700 E0 = 0.021690 ANCL = 72.090 ASMTH = 15.67614

RA1 = -2.52168 W1 = -2.16126 E1 = -2.4600E-04

A0 = 1.05752 A1 = -2.6600E-04

XLAT = 43.15250 XLONG = 0. AD = 6365.30 AZTH = 0.100

ALTH = 0.100 AL0 = 0. XLAT1 = 0. XLONG1 = 0.

TDELAY = 25.00

ORBIT PREDICTION PROGRAM

1 MIN EARLY OBJECT NO. 2108 BLTN NO. 7 4/1766

PASS NO. 302-1 - 0 MIN. EARLY

NODAL CROSSING DATA - DAY NO. 91. , 8. HRS. 32. MIN. 57. SEC. - LAMBDA = 96.100

RISE TIME - 12 HRS. 4 MIN. 47 SEC. EDT

TIME	AZIMUTH		ELEVATION		RANGE
SEC.	DEGREES	RADIANS	DEGREES	RADIANS	KM.
0	352.530	6.15282	0.003	0.00005	2031.20
5	353.011	6.16121	0.316	0.00552	1999.07
10	353.507	6.16986	0.634	0.01106	1967.08
15	354.019	6.17880	0.956	0.01669	1935.21
20	354.547	6.18802	1.283	0.02239	1903.50
25	355.093	6.19754	1.615	0.02818	1871.94
30	355.657	6.20738	1.951	0.03406	1840.54
35	356.240	6.21755	2.293	0.04002	1809.31
40	356.842	6.22808	2.640	0.04608	1778.26
45	357.466	6.23896	2.993	0.05224	1747.41
50	358.112	6.25024	3.351	0.05849	1716.75
55	358.782	6.26192	3.715	0.06484	1686.32
60	359.475	6.27401	4.085	0.07130	1656.11
65	.196	0.00342	4.461	0.07786	1626.14
70	.941	0.01642	4.843	0.08453	1596.42
75	1.715	0.02994	5.232	0.09131	1566.98
80	2.520	0.04398	5.627	0.09821	1537.83
85	3.355	0.05856	6.028	0.10522	1508.97
90	4.224	0.07372	6.437	0.11234	1480.44
95	5.127	0.08948	6.851	0.11958	1452.26
100	6.067	0.10588	7.273	0.12693	1424.43
105	7.045	0.12295	7.701	0.13440	1397.00
110	8.063	0.14072	8.135	0.14199	1369.97
115	9.123	0.15923	8.576	0.14968	1343.38
120	10.228	0.17851	9.023	0.15748	1317.25
125	11.379	0.19860	9.476	0.16538	1291.61
130	12.578	0.21954	9.934	0.17338	1266.49
135	13.829	0.24136	10.397	0.18146	1241.92
140	15.132	0.26411	10.864	0.18961	1217.94
145	16.491	0.28782	11.335	0.19783	1194.59
150	17.906	0.31253	11.808	0.20609	1171.89
155	19.382	0.33827	12.282	0.21437	1149.90
160	20.918	0.36509	12.757	0.22266	1128.65
165	22.518	0.39301	13.231	0.23092	1108.18
170	24.182	0.42206	13.701	0.23913	1088.54
175	25.913	0.45226	14.167	0.24725	1069.77
180	27.710	0.48363	14.625	0.25525	1051.93
185	29.575	0.51618	15.074	0.26308	1035.06
190	31.507	0.54990	15.510	0.27070	1019.21
195	33.505	0.58478	15.932	0.27806	1004.42
200	35.569	0.62080	16.336	0.28511	990.75
205	37.697	0.65793	16.719	0.29180	978.24
210	39.884	0.69611	17.077	0.29806	966.94
215	42.129	0.73529	17.409	0.30384	956.89
220	44.425	0.77537	17.710	0.30910	948.12
225	46.769	0.81627	17.978	0.31377	940.68
230	49.152	0.85787	18.209	0.31781	934.60
235	51.569	0.90005	18.402	0.32118	929.90
240	54.012	0.94268	18.555	0.32384	926.61

ORBIT PREDICTION PROGRAM

1 MIN EARLY OBJECT NO. 2108 BLTN NO. 7 4/1/66

PASS NO. 302-1 - 0 MIN. EARLY

NODAL CROSSING DATA - DAY NO. 91. , 8. HRS. 32. MIN. 57. SEC. - LAMBDA = 96.100

RISE TIME - 12 HRS. 4 MIN. 47 SEC. EDT

TIME	AZIMUTH		ELEVATION		RANGE
SEC.	DEGREES	RADIANS	DEGREES	RADIANS	KM.
245	56.472	0.98562	18.665	0.32577	924.73
250	58.940	1.02870	18.733	0.32694	924.28
255	61.409	1.07179	18.756	0.32736	925.26
260	63.868	1.11471	18.737	0.32702	927.66
265	66.311	1.15734	18.674	0.32593	931.48
270	68.727	1.19951	18.570	0.32411	936.69
275	71.110	1.24111	18.426	0.32160	943.27
280	73.453	1.28199	18.245	0.31843	951.19
285	75.748	1.32206	18.028	0.31465	960.42
290	77.992	1.36121	17.779	0.31030	970.93
295	80.178	1.39938	17.500	0.30544	982.65
300	82.304	1.43648	17.195	0.30010	995.57
305	84.367	1.47248	16.866	0.29436	1009.62
310	86.364	1.50734	16.516	0.28826	1024.76
315	88.294	1.54103	16.149	0.28185	1040.95
320	90.157	1.57354	15.767	0.27518	1058.13
325	91.953	1.60488	15.372	0.26830	1076.25
330	93.681	1.63505	14.968	0.26124	1095.27
335	95.344	1.66406	14.556	0.25405	1115.15
340	96.941	1.69194	14.138	0.24675	1135.82
345	98.476	1.71872	13.716	0.23939	1157.26
350	99.949	1.74443	13.292	0.23199	1179.42
355	101.362	1.76910	12.866	0.22456	1202.25
360	102.718	1.79277	12.441	0.21713	1225.73
365	104.019	1.81547	12.017	0.20973	1249.80
370	105.266	1.83724	11.595	0.20236	1274.44
375	106.463	1.85813	11.175	0.19504	1299.62
380	107.611	1.87817	10.759	0.18779	1325.30
385	108.713	1.89740	10.347	0.18059	1351.45
390	109.770	1.91585	9.940	0.17348	1378.04
395	110.785	1.93356	9.536	0.16644	1405.06
400	111.760	1.95058	9.138	0.15949	1432.47
405	112.696	1.96692	8.745	0.15263	1460.24
410	113.596	1.98262	8.357	0.14586	1488.37
415	114.461	1.99772	7.974	0.13918	1516.82
420	115.293	2.01224	7.597	0.13259	1545.59
425	116.093	2.02621	7.225	0.12610	1574.64
430	116.864	2.03966	6.858	0.11970	1603.97
435	117.606	2.05262	6.497	0.11339	1633.55
440	118.321	2.06510	6.141	0.10718	1663.38
445	119.011	2.07713	5.790	0.10105	1693.44
450	119.676	2.08874	5.444	0.09501	1723.72
455	120.317	2.09994	5.103	0.08906	1754.19
460	120.937	2.11075	4.767	0.08319	1784.86
465	121.535	2.12119	4.435	0.07741	1815.72
470	122.114	2.13128	4.108	0.07170	1846.74
475	122.673	2.14104	3.786	0.06608	1877.93
480	123.213	2.15048	3.468	0.06053	1909.26
485	123.737	2.15961	3.154	0.05505	1940.75

ORBIT PREDICTION PROGRAM

1 MIN EARLY OBJECT NO. 2108 BLTN NO. 7 4/1/66

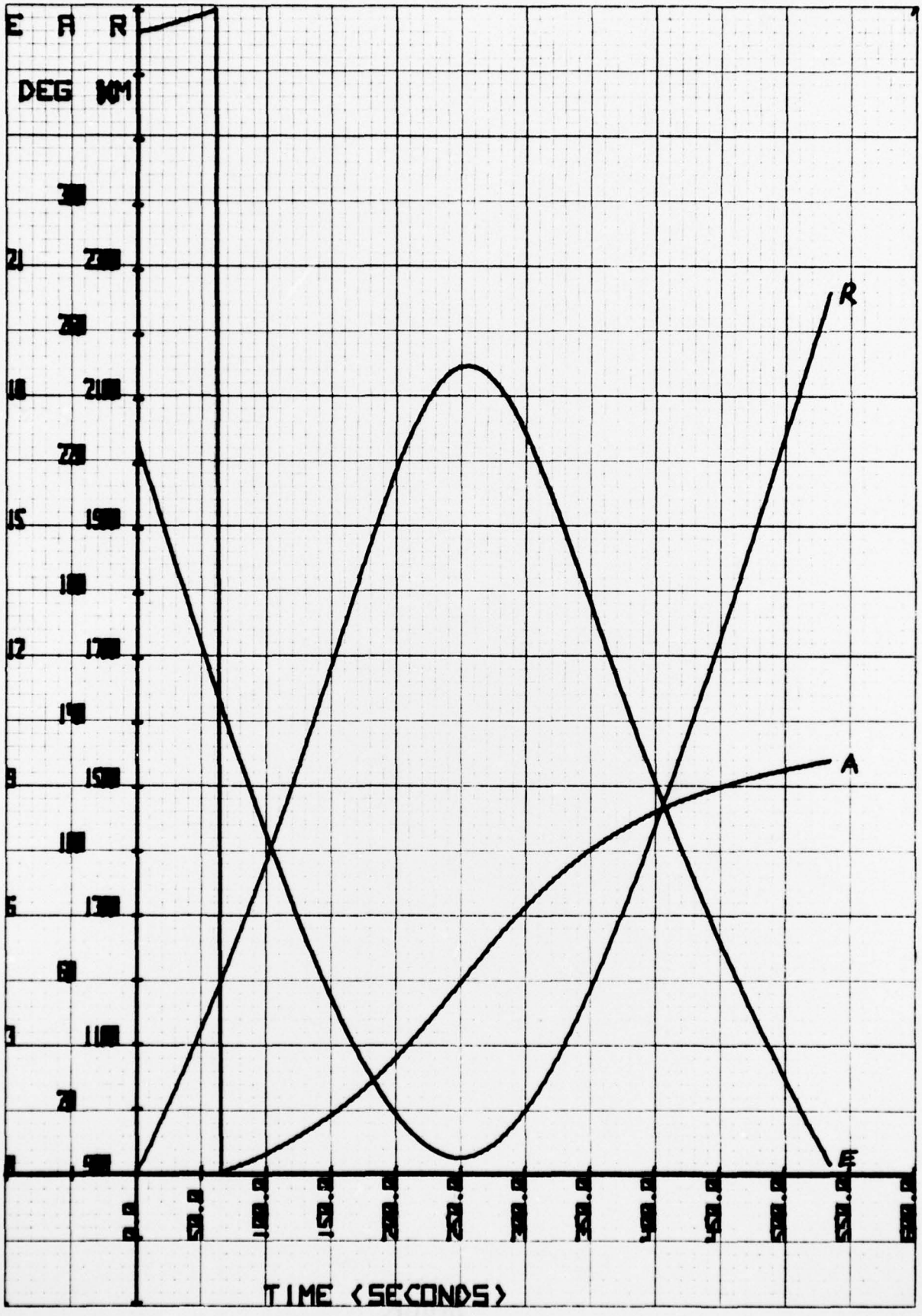
PASS NO. 302-1 - 0 MIN. EARLY

NODAL CROSSING DATA - DAY NO. 91. , 8. HRS. 32. MIN. 57. SEC. - LAMBDA = 96.100

RISE TIME - 12 HRS. 4 MIN. 47 SEC. EDT

TIME	AZIMUTH		ELEVATION		RANGE
SEC.	DEGREES	RADIANS	DEGREES	RADIANS	KM.
490	124.243	2.16845	2.845	0.04965	1972.36
495	124.734	2.17702	2.539	0.04432	2004.11
500	125.210	2.18532	2.238	0.03905	2035.98
505	125.671	2.19337	1.940	0.03385	2067.96
510	126.118	2.20117	1.645	0.02872	2100.05
515	126.552	2.20875	1.355	0.02364	2132.25
520	126.973	2.21610	1.067	0.01863	2164.54
525	127.382	2.22324	0.783	0.01367	2196.92
530	127.780	2.23018	0.503	0.00877	2229.39
535	128.166	2.23692	0.225	0.00393	2261.94

Plot from the Sample Output



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